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The Vegetation and Flora of the Region of the Río de Bavispe in Northeastern Sonora, Mexico*

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INTRODUCTION

The present study of the botanical features of the region of the Río de Bavispe, one of the larger tributaries of the Río Yaqui, was undertaken to advance our knowledge of an area which, to quote Mearns (27): "to this day . . . remains the principal *terra incognita* of Mexico . . . certain to yield many new species of plants and animals when its exploration becomes possible." Whether this is the principal *terra incognita* of all Mexico may well be questioned, but it certainly is one of the least known regions of the north Mexican border.

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In the following pages an attempt will be made to describe the salient features of the vegetation, and to delineate the relationships of the flora. It is hoped that this treatment will partially fill the gap which has long existed in our knowledge of the vegetation of north-western Mexico. The desert regions of Sonora on the west, and of Chihuahua on the east, are fairly well known, but up to now north-eastern Sonora (for that matter practically all of the eastern part of the state) has been almost completely neglected by botanists.

PREVIOUS EXPLORATIONS IN NORTHEASTERN SONORA

The period of Spanish explorations in what is now the state of Sonora began in 1533 when Diego de Guzman reached the lower Río Yaqui from the south.¹ Two or three years later Alvar Núñez Cabeza de Vaca, after an overland trip from the Texas coast, arrived at an Indian village, which he called "Corazones," situated on the upper reaches of either the Río Yaqui or Río Sonora. He was the first European to see this part of Sonora, as well as the territory through which he had just traveled. There followed a number of expeditions to the north, some of them reaching the Gila River, and at the same time missions and settlements were being established. The first mission in Sonora was founded among the Mayo Indians in 1613. Missionaries entered the upper Yaqui territory in 1617, and in 1638 Padre Bartolomé Castaño began his residence among the Opata Indians. About 1640 the Franciscan friars reached Bavispe, and perhaps other towns on the Río de Bavispe. Oposura (Moctezuma) was founded in 1640. The church of Bacadéhuachi was built sometime before 1655.

The first English description of Sonora appears to be that of Hardy (16), who traveled over much of Mexico during the years 1825-27. Scarcely any mention is made of the vegetation although in his "general outline" of the province of Sonora he lists the principal plant products as follows:

"The soil produces wheat, maize, beans, sugar, cotton, cardons, pines, aspin, seven or eight species of oak, chino, mesquite, willow, poplar, ash, palofierro, guayacán, palobrazil, tisota, tesita, pitch-tree, palo blanco, paloverde, palo axtac, palo guavavillo, and lignum vitae. Add copal, palo samóca, which produces the gomilla, or gum of California, chestnut, walnut, cherry, peach, apple, pear, orange and grape.

"Of herbs there is also a great variety, among which are senna and jalap.

"Of resins there is a good kind obtained from the petaya (a species of cactus), which, when mixed with tallow, makes a good tar for ships, gum arabic, dragon's blood, gum lac, cooutchouc, which the Indians dissolve in the juice of the higuierilla (the shrub which produces castor oil). There are several fragrant gums besides copal."

In his record of travels through northeastern Sonora Hardy mentions the presence of oaks and grass at "Guepare" (probably the Huépari of this paper), and at Peñualas, Chihuahua, a short distance beyond Carretas, he found oak, walnut, and wild cherry.

Hardy derives the name Bavispe from the Opata "babipa" which he states means "the point where the river takes a new course." This interpretation is based on a mistaken notion as to the location of Bavispe,

¹Data for this sketch of the early Spanish explorations are largely taken from Bancroft (2) and Bandelier (3).

for his map, as well as some earlier ones, shows Bavispe in the position that Colonia Oaxaca now occupies. Here the river does take a new course, to the westward, but at Bavispe there is no change of course. Although not giving us any clue to the meaning of the word, Bandelier (3) makes it clear that the name comes from a group of Opatas Indians known as "Bapispes." Similarly other towns in this region took their name from various groups of the Opatas, e.g., Guásabas or Huásabas (Buasdabas), Cumpas (Cumupas), Nacozari (Nacosuras) and Ures (Hures).

Real botanical knowledge of northern Sonora began with the Mexican Boundary Survey of 1848 (52). Six botanists were attached to the surveying parties, but at this date only the steps of Thurber can be traced in detail (for part of the survey period) thanks to Bartlett's journal (4). The travels of Wright in southwestern United States have been summarized by Wooten (62). The itineraries of the other botanists, Parry, Bigelow, E. K. Smith and Schott, are so obscure that even Rodgers (33, 34) and Waller (58), writers on the botany and botanists of this period, do not attempt to trace them. Nevertheless, it is evident from Torrey's "Botany of the Boundary" (52) that all of them collected in Guadalupe Canyon and Pass in extreme north-eastern Sonora, near the Arizona-New Mexico boundary, and at Santa Cruz in north central Sonora.

Returning to Thurber, his collections were made along his route from Guadalupe Canyon westward to near the present location of Agua Prieta, and thence to Fronteras, Mábari and Arizpe. He returned to the Copper Mines in New Mexico, his original starting point, by the same route. Later, on a trip eastward from California, he passed through Santa Cruz, San Bernardino, and again through Guadalupe Canyon.

In an effort to determine which of the many Sonora localities given in the "Botany of the Boundary" are in the area treated here it was necessary to spend considerable time identifying all the place names credited to this state. Places located in northeastern Sonora are the following: Guadalupe Canyon and Pass (also partly in Arizona and New Mexico), San Bernardino, Fronteras, Mábari (spelled Mababi and Mabibi by Torrey) and Blackwater Creek (Agua Prieta).

A number of places, mistakenly assigned to Sonora by Torrey, are actually in Arizona, New Mexico, Chihuahua or even Texas. Below is a list of these places with the correct or probable location indicated:

<i>Sonora Place Name as Given by Torrey</i>	<i>Actual or Probable Location</i>
Janos, or Yanos.....	Janos, Chihuahua
Sierra de los Tanos.....	Probably Sierra de los Janos, Chih.
Las Playas.....	Las Playas, New Mexico
Piloncilla.....	Sugar Loaf Mountain, Arizona
Puerto del Paisano.....	Probably near Paisano, Texas
Tubac.....	Tubac, Arizona
Sonoita (Wright's locality)....	Sonoita, Arizona, south of Tucson
San Francisco Springs.....	Ojo de San Francisco, in extreme northwestern Chihuahua
Bufotillo Ranch.....	Probably Bofecilla Ranch, Texas
Babocomori.....	Babocomori, Arizona
Babuquibari.....	Babuquibari, Arizona
Las Animas.....	Las Animas, New Mexico
Socosso.....	Probably Socorro, Chihuahua, southeast of Ciudad Juárez. This locality is shown on Bartlett's map (4).

The following localities I have been unable to identify: El Podrero (Potrero?), San Esteban (possibly in Texas), Tásate, Agua Zarca, Sierra de Nayos, Camp Tezotat and Punta de Agua.

After the first boundary survey no further scientific investigations were carried out in northern Sonora until the entry of Bandelier in 1880 for the purpose of making ethnological studies (3). In his introduction he gives a brief and general outline of the topography, geology, climate, flora and fauna of the area with which he was concerned, i.e., New Mexico, Arizona, Sonora and Chihuahua. A valuable feature of his book is the copious use of quotations from the records of the early Spanish chroniclers, many of them in manuscript form and not readily accessible.

A few notes on the nature of the country along the San Bernardino and upper Bavispe Rivers are given by Rourke (6), who in 1883 accompanied Gen. Crook's expedition into Sonora and Chihuahua in pursuit of the Apache Indians.

In 1890 the Lumholtz archaeological expedition left Bisbee, Arizona, and passed through the Sonoran towns of Fronteras, Cochuta, Oputo, Guásabas, Bacadéhuachi and Nácori en route to the highlands of western Chihuahua (24). From here the expedition turned southward and finally reached Mexico City. Considering that two botanists, Hartman and Lloyd, accompanied Lumholtz, surprisingly little botanical information resulted from these explorations. Lumholtz himself paid scant attention to the vegetation, and the only strictly botanical publication on the collections of Hartman and Lloyd is a paper by Robinson and Fernald (31) devoted mainly to descriptions of new species.

Two years after Lumholtz and his party had passed into Chihuahua, Mearns of the second Mexican Boundary Survey was gathering materials for what was to be the second important contribution to the botany of northeastern Sonora, although his activities were necessarily confined to the immediate vicinity of the boundary. Mearns' primary interest was the mammals of the region, but he recognized the importance of presenting as complete an account as possible of their environment. His "Mammals of the Mexican Boundary of the United States" (27) is as a result the first coherent account of the vegetation of the border. He devotes several pages to the "general character of the region explored" and to the "flora of the Mexican boundary region"; in addition he gives lists of plants found at his collecting stations, all of which are carefully located with reference to towns, boundary markers or unmistakable topographic features. Unfortunately, Mearns gave little attention to strictly herbaceous plants; and grasses, which are of prime importance throughout the southwest, are scarcely mentioned.

On the border immediately north of the Río de Bavispe Mearns collected in the San Luis Mountains, on the Sonora-Chihuahua boundary; at the head of the "right fork of the Cajón Bonito Creek," a tributary of the San Bernardino; Animas Valley; Hall's Ranch; Guadalupe Canyon; near the mouth of Cajón Bonito Creek; Agua Prieta Ranch; Piedras Negras and Sulphur Spring Valley.

In the adjoining portion of Chihuahua, E. W. Nelson, E. A. Goldman and Townsend and Barber collected in the vicinity of Casas Grandes and some of the Mormon colonies during the years 1898 and 1899.

Marcus E. Jones worked in this same area in 1903. Finally, Harde La Sueur, about a decade ago, explored much of northern Chihuahua, and his observations were published in 1945 (22). According to his own statement, however, he did not visit any part of northwestern Chihuahua except Las Palomas.

PRESENT EXPLORATIONS

My field work in northeastern Sonora began in the summer of 1938 when I accompanied Dr. Ralph W. Imlay, then of the University of Michigan Museums, who was engaged in making a paleogeographical survey of the area. Collections were made in the vicinity of Moctezuma, Colonia Oaxaca, Cañón de Santa Rosa, Arroyo del Púlito, and Carretas, Chihuahua on the Sonora border. In 1939 I was accompanied by LeRoy H. Harvey, who was interested primarily in securing materials for his forthcoming monograph of the genus *Eragrostis*; most of the summer was spent in Texas, Nuevo León, Coahuila and Chihuahua, and only the first two weeks of September were allotted to collecting in Sonora. This period was spent at Huépari, between Oputo and Huachinera. The collections made in other states, except those of Carretas, Chihuahua, are not included in this report.

The third field trip, in 1940, was made in company with Edwin Allen Phillips, who devoted most of his time to the collection of bryophytes.² The area covered on this trip extends from Bavispe and Huachinera westward to Las Tierritas and Oputo; in addition a rapid reconnaissance survey was made from Oputo southward to Guásabas and then eastward to Bacadéhuachi and northeastward to Huachinera. Extremely dry conditions prevailed at the time of this survey, and collections were made only at Aguaje de Bacatejaca, La Palmita and La Galera. Within the Bavispe River area proper, however, some of the larger canyons of the eastern slopes of the Sierra del Tigre were thoroughly explored, as well as the pine land in the vicinity of Las Tierritas.

José Vera Santos, an agrostologist, accompanied me on the final trip in 1941. His collections were almost exclusively grasses. The principal collecting stations this year were Agua Prieta, Hacienda de San Rafael, La Nacha, Colonia Morelos, the northern end of the Sierra del Tigre, and a portion of the Sierra de la Cabellera.

The region circumscribed by the loop of the Bavispe River, which was selected for intensive study, varies in width from 29 to 32 kms. and measures about 80 kms. in length. The total area therefore is over 2400 square kms. Although not particularly large for a phyto-geographic study, the vegetation within this area presents sufficient variation (from desert to pine forest) to justify the time spent on it.

Some of our collecting stations can be reached by car, but most of our work was carried out in places far removed from automobile roads. Much of our travel was therefore on horseback, and on long trips as many as four or five pack mules were required to carry our equipment. On such trips plants as collected were dried over coals.

At all of the principal collecting stations it was my aim to secure

²The mosses are the subject of a supplementary paper being prepared by Dr. W. C. Steere.

a complete representation of the pteridophytes, gymnosperms and angiosperms growing in the locality. This led perhaps to an excessive number of collections of some of the common species, yet this practice makes it possible more readily to compare one site with another. Had this method not been followed, undoubtedly a number of species not easily distinguished in the field, as in the genus *Euphorbia*, would have been overlooked. I am confident, therefore, that few species of summer-flowering plants have been omitted, although I am well aware, as will be pointed out later, of the existence of certain plants which were not collected.

TOPOGRAPHY, GEOLOGY AND SOILS

The nature of the topography of northeastern Sonora can be judged by the drainage pattern. The rivers, with the exception of the Fronteras and the upper arm of the Bavispe, flow from north to south, paralleling the mountain ranges and having their sources near the international boundary or north of it. The elevation of the land increases therefore toward the headwaters of the rivers in the north and toward the Sierra Madre Occidental on the east. The highest points, however, are not located on the border but about 75 kms. south of it at the northern end of the Sierra del Tigre,³ and in the adjacent portion of the Sierra Madre. North of here the country is characterized by more or less undulating plains with scattered ranges of low mountains.

The Sierra del Tigre, lying between the two arms of the Bavispe River, becomes higher and more massive northward, and ends abruptly just south of the northern bend of the river. Here there is a descent of more than 1000 m. in a distance of a little more than 5 kms. Considering that there are peaks rising to a height of nearly 2400 m. (perhaps some are even higher), deep canyons cut through solid rock (Fig. 26), and nearly everywhere a rugged terrain, it is not without reason that Bandelier (3) spoke more than once of "the formidable Sierra de Teras."

Inlay (18) has described the geological features of northeastern Sonora. In brief the rock formations represented are Quaternary conglomerates, Tertiary igneous rocks, Permian and Cretaceous limestones, and occasional outcrops of Paleozoic rocks. Lava, ash deposits and other evidences of vulcanism are widespread.

The soils are for the most part thin and stony, and those of the lowlands are practically devoid of humus. Overgrazing and consequent sheet and gully erosion are of general occurrence (Fig. 11). Along the rivers and in some of the larger canyons there are deposits of alluvium which, because they are easily irrigated, are the only lowland areas under cultivation.

In the high mountains there are a number of meadows (Fig. 14), usually rather small in size, which may once have been lakes. These meadows, with their muck soils, are sometimes cultivated.

CLIMATE

Brand (8) has described the climate of northwestern Chihuahua, and Turnage and Mallery (54) have analyzed that of the Sonoran desert. From these studies it is possible to outline in a general way

³Sometimes called Sierra de la Madera and Sierra de Teras.

the climatic features of northeastern Sonora. Brand has characterized the climate of northwestern Chihuahua as follows:

"The climatic complex can be described as involving low relative humidity (highest in September and least in May), intense insolation (least in December and January, most in June), excessive evaporation (over 2,000 mm. in the desert), considerable daily and seasonal temperature ranges, summer convectional rainy season with cyclonic minor maximum in December and January, prevalence of southwest winds of about 10 m.p.h. average velocity, and a generally intense light."

The above is no doubt true of northeastern Sonora, although there are no meteorological data available from this area.

According to Turnage and Mallery, the winter precipitation varies from 0 to 125 mm., and the summer precipitation from 250 to 380 mm.; thus the rainfall is at least twice as heavy in summer as in winter. They do not state to what elevations these values apply, but the upper limit apparently is not much above 1200 m. Douglas, Arizona, at approximately 1200 m. elevation, has an average annual precipitation of 324 mm. (55).

From the temperature records of southeastern Arizona, southwestern New Mexico (55) and northwestern Chihuahua (8), it is evident that none of these areas is free of annual frosts. How far south the zone of annual frosts extends (considering here only low elevations) is uncertain, but Haurwitz and Austin (17), without giving the source of their information, state that the average annual temperature extremes at Ures, Sonora (elevation 430 m.) are 0.6° and 42.7° C. This would indicate that frosts are not unusual there, even though they may not be an annual occurrence. During the exceptional cold wave of 1937 frost was reported as far south as Cedros (53).

It appears safe to conclude, therefore, that frosts are an annual occurrence throughout northeastern Sonora. Judging by the data for southeastern Arizona and southwestern New Mexico (55), the length of the frost-free period probably varies from 200 to 230 days, according to elevation. As LeSueur (22) has pointed out, however, the initiation of plant growth is quite as dependent on the beginning of the rainy season as on the cessation of frost, and the growing season may be reduced to as little as 90 days.

In his map of the dry climates of the United States, Russell (35) classifies the climate of southeastern Arizona and southwestern New Mexico as BWhw (hot desert with dry winters) with islands of BShw (hot steppe with dry winters). This is a much broader concept of a desert than is held by Shreve (44) and other students of desert vegetation. A small vegetation map presented in the same paper, although used to illustrate another matter, describes this area as "grasslands and forests;" this in itself would indicate that his definition of a desert is too inclusive.

More nearly conforming to the types of vegetation is Brand's map of the climates of northwestern Chihuahua and adjacent Sonora (8). The climates are here classified according to Koppen's system. In general Brand gives each type of climate a more humid classification compared to Russell's system, i.e., some of Russell's desert areas become steppe (BShw) and steppe becomes warm temperate rainy climate (Cw).

In a later study of the dry climates of the United States Russell (36) presents evidence that in southern Arizona and New Mexico "desert years" occur about as frequently as "dry years" and therefore a close approach to desert conditions is to be expected. This is indeed true in northeastern Sonora, as will be brought out more fully in the discussion of the vegetation.

Three principal types of vegetation may be recognized in northeastern Sonora: mesquite-grassland, oak-grassland and pine forest. To summarize the climatic features of these types the following table presents their approximate altitudinal ranges, estimated average annual precipitation and mean annual temperature, and the corresponding climatic symbol, using Koppen's classification. These figures are meant to apply particularly to the Sierra del Tigre.

Type of Vegetation	Vertical Range	Av. Ann. Precip.	Mean Ann. Temp.	Climatic Symbol
	m.	mm.	° C.	
Mesquite-grassland.....	below 1100	250-350	18-20	BShw
Oak-grassland.....	1100-1800	350-475	12-18	BShw
Pine forest.....	above 1800	475-650*	8-12	Cw

*Both Brand (8) and LeSueur (22) estimate that in places the average annual precipitation in the pine forest may reach 800 mm.

VEGETATION

The Bavispe River area, as well as the surrounding territory, lies within the Apachian biotic province as defined by Dice (11), who recognizes four life zones: desert, arid grassland, encinal (oak-woodland), and a montane belt consisting mainly of pine forests. The last three of these are present in the vicinity of the loop of the Bavispe River; each is discussed below under the headings Mesquite-grassland, Oak-grassland and Pine forest. The desert zone, which might well be recognized, occupies a relatively small area along the lower river valley, and is therefore treated as a desert community within the mesquite-grassland.

The altitudinal limits of the vegetational zones were presented in the section on climate. These are meant to apply only to the Sierra del Tigre and the areas lying immediately to the east and west. Farther north the limits are shifted upwards, an effect, apparently, of the lack of mountains high enough to intercept and cool moisture-laden winds. Thus in the Sierra de la Cabellera the mesquite-grassland persists to an altitude of more than 1200 m., and at 1830 m. there is not a trace of pine forest, although in the Sierra del Tigre the pine forest is well developed at this altitude.

Mesquite-Grassland

This is the most extensive association of northeastern Sonora. As Brand (7) has mapped it, it reaches in the northern half of the state from the Sierra Madre westward to near the position of the Southern Pacific Railway; toward the south it gradually becomes narrower and reaches its limit near Ciudad Obregón. In the Bavispe River area the

mesquite-grassland forms a narrow band along the river as far as Huachinera (see map), being confined on the east between the Sierra Madre and the Sierra del Tigre, and on the west between the latter range and the Sierra de Oposura. Northward, however, it continues in an unbroken stretch to the United States border.

In composition the mesquite-grassland correspond rather closely to what Nichol has called in Arizona "Desertland grass" (29). The commonest and most conspicuous plants in this type of vegetation are *Prosopis chilensis*, *Larrea divaricata*, *Acacia constricta*, *Fouquieria splendens* and various species of *Opuntia* and other cacti. With the exception of *Larrea*, which does not extend south of the Bavispe River,⁴ these plants are to be found throughout the mesquite-grassland, although their relative abundance and minor associates vary from place to place. Widespread but less common shrubs are *Celtis pallida*, *Rhus microphylla*, *Condalia lycioides*, *Ephedra trifurca*, *Jatropha cardiophylla*, *Parthenium incanum*, *Selloa glutinosa*, and various *Acalyphas* and *Crotons*.

The species of herbaceous plants, including grasses, are numerous, yet they rarely form a complete ground cover. The densest herbaceous vegetation is found in the shade of mesquite and other trees and shrubs, and as these are widely spaced, except on alluvial land, there is much bare ground even in the rainy season.

The principal grasses of the mesquite-grassland are *Sporobolus Wrightii* (Fig. 15), *Hilaria mutica*, *H. Belangeri*, *Aristida Adscensionis*, several *Boutelouas*, especially *B. Rothrockii*, *Echinochloa colonum*, *Cynodon Dactylon*, *Cenchrus pauciflorus*, *Digitaria sanguinalis*, *Muhlenbergia Porteri*, *Pappophorum Wrightii*, *Setaria macrosyachya*, *Triodia mutica* and *T. pulchella*. Other herbaceous plants are mostly members of the *Compositae*, *Euphorbiaceae*, *Malvaceae* and *Nyctaginaceae*; it is scarcely necessary to add that there is no lack of chenopodiums, amarantus and other weeds common to inhabited places.

An account of the different habitats within the mesquite-grassland can be most conveniently given by describing in detail one of the most important collecting stations, with references to conditions in other places.

The most extensive collections of the lowland vegetation were made in the vicinity of Colonia Morelas. This village, like Colonia Oaxaca farther east, was founded by the Mormons some time prior to 1890, and was abandoned by its founders about 1910 as a consequence of the Mexican Revolution. The substantial brick houses of the Mormons, which are still standing, make a strange contrast with the adobe buildings found in typical Mexican villages.

Colonia Morelos, with a population of perhaps 800, is located at the confluence of the Bavispe and San Bernardino⁵ Rivers and has an elevation of 795 m. Immediately to the south lies the abrupt northern

⁴Dr. W. J. Spencer, a resident of Bacerac, has informed me in a personal communication that creosote bush is present near that village. This is probably an isolated colony, for I failed to find it on several trips through the area. It is not present at Colonia Oaxaca, Bavispe or Huachinera, where I spent considerable time.

⁵Locally called "Rio Batepi" (raccoon).

end of the Sierra del Tigre which in a distance of a few kilometers rises to a height of more than 2100 m. About 16 km. to the east one encounters the lower and more arid Sierra de la Cabellera which, in the places visited at least, barely reaches an elevation of 1840 m.

The concentration of human settlement along the river valley has brought about considerable modification of the natural vegetation through agriculture, grazing and the cutting of mesquite and other trees for fuel and construction. These activities, carried on without any thought of conservation, inevitably bring about deterioration of the soil, and the natural landscape therefore acquires a more arid aspect than one would expect from the climatic conditions.

Near Colonia Morelos the principal habitats are the alluvial flats near the river, the more elevated *Larrea* plains, cactus plains, and finally the transition to the oak-grassland. Each of these is described below.

Plants of the Alluvial Flats.—The riparian vegetation will be discussed below. Away from the immediate shore line, and generally above the high-water mark during flood times, there is a narrow strip of nearly level alluvial land bordering the north bank of the Río de Bavispe and the east bank of the Río San Bernardino. It is here that the mesquite is most abundant, and when left undisturbed it forms dense thickets with a canopy 5 or more meters high. In 1941 Santos and I had an opportunity to study a mesquite thicket which for a number of years had been fenced off and protected from animals and woodcutters. This area undoubtedly represented the closest approach to the natural vegetation on this type of habitat that could be found in the vicinity.

The only tree of importance is *Prosopis*. In small clearings *Sambucus coerulea*, *Celtis reticulata*, *Acacia Greggii*, *Cercidium praecox*, *Lycium Andersonii*, *L. Torreyi* and *Condalia spathulata* may occur. The *Sambucus* and *Celtis* reach a height of 8 m. or more and thus overtop the average mesquite, but they are not numerous enough to be considered a dominant, or even prominent, element of the vegetation. *Lycium*, *Condalia* and *Acacia* occur only sporadically in the mesquital, as they are more characteristic of dry rocky hillsides.

The herbaceous ground cover is composed mainly of sun-loving species, and the greatest variety of plants is to be found in the clearings.

Plants characteristic of the shady areas are:

Rivinia humilis
Acalypha ostryaefolia
Ayenia pusilla

Verbena carolina
Ruellia nudiflora var. *glabrata*
Tetramerium hispidum

Other plants of the alluvial land are:

Bouteloua Rothrockii
Digitaria sanguinalis
Echinochloa colonum
E. Crus-galli var. *mitis*
Leptochloa filiformis
Paspalum distichum
Setaria Grisebachii
S. macrostachya
Chenopodium spp.
Amaranthus Palmeri

Tidestromia lanuginosa
Allionia incarnata
Boerhaavia caribea
B. Coulteri
Portulaca retusa
Cassia leptadenia
Phaseolus heterophyllus
Rhynchosia texana
Kallstroemia californica
Tribulus terrestris

<i>Janusia gracilis</i>	<i>Opuntia</i> spp.
<i>Croton texensis</i>	<i>Haplophyton cnicoidum</i>
<i>Ditaxis serrata</i>	<i>Evolvulus alsinoides</i>
<i>Bidens pilosa</i>	<i>Ipomoea desertorum</i>
<i>Helianthus annuus</i>	<i>Marrubium vulgare</i>
<i>Euphorbia dentata</i> var. <i>cuphosperma</i>	<i>Datura meteloides</i>
<i>E. hyssopifolia</i>	<i>D. quercifolia</i>
<i>E. revoluta</i>	<i>Physalis Wrightii</i>
<i>Abutilon californicum</i>	<i>Solanum elaeagnifolium</i>
<i>A. Pringlei</i>	<i>Martynia fragrans</i>
<i>Sida procumbens</i>	<i>Cucurbita digitata</i>
<i>Sphaeralcea laxa</i>	<i>C. foetidissima</i>
<i>Mentzelia multiflora</i>	<i>Arctium Lappa</i>
<i>Echinocereus rigidissimus</i>	<i>Pectis linifolia</i>
<i>Mammillaria</i> spp.	<i>Verbesina encelioides</i>
	<i>Viguiera dentata</i>

Evolvulus alsinoides and *Ayenia pusilla* apparently are here at the lower limit of their vertical range, for all other collections were made at higher elevations, principally in the oak-grassland.

The only vines collected in this mesquital are *Clematis Drummondii*, *Passiflora mexicana*, *Vitis cinera*, *Cocculus diversifolius*, *Sarcostemma heterophyllum* and *Echinopepon Wrightii*.

Plants observed in this area, but not collected, are: *Cuscuta* sp., growing on *Amaranthus*; *Phoradendron* sp., on *Prosopis* and *Populus*, and *Mirabilis Wrightiana*.

On the banks of an irrigation ditch which runs through the mesquital there are a number of plants characteristic of the riparian vegetation. These are: *Salix Gooddingii* var. *vallicola*, *Populus Fremontii*, *Nicotiana glauca*, *Baccharis glutinosa*, *Ambrosia aptera* and *Polygonum lapathifolium*.

The differences between this protected mesquital and those which have suffered from grazing and deforestation lie not so much in the species present in the two areas, although shade-loving plants are rare or absent where the trees have been cut, as in the density of the vegetation and the proportion of weeds. In unprotected places the stature of woody plants is low, as all large trees are immediately cut for fuel. Grasses are lacking, and other herbaceous plants are of a weedy character, such as *Solanum elaeagnifolium*, *Allionia incarnata*, *Boerhaavia* spp., *Datura* spp. and *Cucurbita foetidissima*.

Plants of the Larrea Plains.—To the north and west of Colonia Morelos, and also for a short distance eastward, the *Larrea* association dominates the landscape. Some portions of this area are relatively flat, but a rolling to rugged topography prevails, although generally with little relief. In traveling from Agua Prieta southward to Fronteras, and southeastward to Colonia Morelos one sees vast stretches of a monotonous vegetation consisting of *Larrea*, *Fouquieria splendens*, *Prosopis*, *Acacia constricta* and a number of minor species.

Although Shreve (44) places the eastern border of the Sonoran Desert near Arizpe and Moctezuma, the vegetation of the *Larrea* and cactus plains (the latter to be described below) has a strong desert aspect. This is to be expected since there exists a direct connection, through the lower Bavispe valley, with the desert area south of Moctezuma.

Besides the plants mentioned above, the following, considered by Shreve (41) to belong to the desert, occur on the *Larrea* and cactus plains:

Celtis pallida
Atriplex canescens
Acacia Greggii
Jatropha cardiophylla
Condalia spathulata

Fouquieria Macdougalii
Lemaireocereus Thurberi
Lycium Andersonii
Bebbia juncea
Encelia farinosa
Hymenoclea monogyra

Other woody plants found here, some of them also associated with desert conditions, are: *Koeberlinia spinosa* (Fig. 10), *Condalia lycioides*, *Parthenium incanum*, *Rhus microphylla*, *Chilopsis linearis*, *Lippia Wrightii*, *Hibiscus denudatus* var. *involucellatus*, *H. Coulteri*, *Coldenia canescens*, *Menodora scabra*, *Polygala macradenia* and *Krameria parvifolia*.

During the rainy season a surprising number of herbaceous species are found in the *Larrea* association. Below is a list of the herbaceous and suffrutescent plants collected:

Notholaena sinuata var. *integerrima*
Aristida ternipes
Bouteloua barbata
B. curtipendula
B. filiformis
B. hirsuta
B. Rothrockii
Cynodon Dactylon
Eragrostis cilianensis
E. pectinacea
Muhlenbergia Porteri
Panicum fasciculatum var. *reticulatum*
P. hirticaule
Pappophorum Wrightii
Setaria Grisebachii
Sporobolus cryptandrus
Triodia mutica
T. pulchella
Eriogonum Abernethianum
Allionia incarnata
Boerhaavia spicata
Molluga verticillata
Cassia Covesii
C. leptocarpa
Calliandra eriophylla
G. microcephala
Haplopappus gracilis

Dalea mollis
D. Parryi
Phaseolus sp.
Janusia gracilis
Croton corymbulosus
Ditaxis neomexicana
D. serrata
Euphorbia capitellata
E. florida
Abutilon incanum
Sphaeralcea Fendleri
Cereus Greggii (Fig. 16)
Mammillaria sp.
Opuntia sp.
Ipomoea leptotoma
Quamoclit coccinea
Q. coccinea var. *hederifolia*
Chamaesaracha Coronopus
Martynia althaeifolia
Siphonoglossa longiflora
Cucurbita digitata
Aster spinosus
Brickellia Coulteri
Franseria tenuifolia
Gutierrezia lucida
Iva ambrosiaefolia
Melampodium cinereum
Zinnia pumila

Worthy of mention is the following group of plants found, in the vicinity of Colonia Morelos, only at Puerto del Molino Quemado, a rocky hill with an elevation of 1000 m.:

Ephedra trifurca
Phaulothamnus spinescens
Acacia millefolia

Eysenhardtia orthocarpa
Nissolia Schottii
Dodonaea viscosa
Lycium Berlandieri

This is the only station for this species of *Lycium*, and the *Phaulothamnus* was found elsewhere only at Tonibabi.

Plants of the Cactus Plains.—This is a minor subdivision of the mesquite-grassland, confined to the low river valley from Colonia

Morelos southward. This and the *Larrea* plains constitute the desert community of the Bavispe River region.

La Vega Azul (elev. 760 m.), on the south side of the river and southwest of Colonia Morelos, may be considered the northern end of the cactus plains. It is sharply set off from the *Larrea* plains on the north by the complete absence of *Larrea*, and by a greater abundance of various cacti, of which *Opuntia fulgida* (Fig. 18) is the most numerous. *Opuntia spinosior* (Fig. 22) and other species of the genus are also present, and the genera *Echinocereus*, *Cereus*, *Mammillaria* and perhaps others are also represented.

South of San Juan del Río *Lemaireocereus Thurberi* (Fig. 16) becomes common, reminding one of the sahuaro forest of Arizona. *Fouquieria Macdougalii*, *Bumelia occidentalis* and *Sapium biloculare*, whose distribution lies mainly to the west and south, are associated with the pitaya, and the Bavispe River valley is probably their eastern limit.

Our southernmost collections were made along the trail between Guásabas and Bacadéhuachi. This trail defines almost exactly the northernmost extension of the Sinaloan avifaunal province as mapped by van Rossem (56). Although the thorn forest of the Sinaloa lowlands is not developed here (Fig. 33 perhaps represents an approach to it), some of the plants collected at Aguaje de Bacatejaca and La Palmita, as well as at Moctezuma and Tonibabi, clearly proclaim the beginnings of a different biotic province. The following plants of the Sinaloan province apparently have their northern limits at this latitude:

<i>Ficus petiolaris</i>	<i>Stemmadenia tomentosa</i> var. <i>Palmeri</i>
<i>Acacia pennatula</i>	<i>Ipomoea aborescens</i>
<i>Esenbeckia Hartmanii</i>	<i>Palo del astro</i> ⁶
<i>Ceiba acuminata</i>	<i>Parthenium Stramonium</i>

The following plants are also members of the Sinaloan vegetation (42), and their northernmost stations in the Bavispe River area, according to our collections, are as indicated:

<i>Phaulothamnus spinescens</i>	Colonia Morelos
<i>Acacia cymbispina</i>	Huépari
<i>Lysiloma microphylla</i>	Cañón del Agua Amarga
<i>Mascagnia macroptera</i>	Cañón de Santa Rosa
<i>Lagascea decipiens</i>	Cañón del Carricito (a branch of the Estacas)

All of these Sinaloan plants are rare in the Bavispe region, as is to be expected at the periphery of their geographical range.

Upper Limits of the Mesquite-Grassland.—Colonia Oaxaca, at an elevation of 915 m., may be taken as the upper limit of the desert conditions prevailing in the lower river valley. From this point southward to Huachinera (elev. approximately 1000 m.) *Larrea* is absent, *Fouquieria* diminishes in numbers, and *Prosopis* acquires a number of new associates, including: *Eysenhardtia orthocarpa*, *Mimosa biuncifera*, *M. laxiflora*, *M. Wrightii*, *Erythrina flabelliformis*, *Celtis reticulata*, *Rhus virens*, *Dodonaea viscosa*, *Tecoma incisa* and many grasses and herbs. A quite complete ground cover makes a favorable contrast with the expanses of bare ground at lower elevations, and is a good indication

⁶Not collected. According to Martínez (25) and Standley (47) this is *Cordia Sonorae* Rose.

of ameliorated moisture conditions. On the western slopes of the Sierra del Tigre *Washingtonia Sonorae* occurs sporadically (Fig. 21).

At 1000 m. the first oaks and junipers appear, marking the beginning of the oak-grassland. Of the eleven species of oak found in the area, only *Quercus chihuahuensis* is regularly present at this elevation, but *Q. Toumeyi* may also occur.

Oak-Grassland

This association begins at an elevation of approximately 1100 m. and continues upward to about 1800 m. Within the loop of the Bavispe River the oak-grassland forms a narrow band above the mesquite zone, varying in width from 4 or 5 kilometers in the north to about 15 kilometers in the south. Unlike the lowland regions, where only the largest canyons have a permanent stream of water, in this zone many of the lesser water courses, if dry at all, become so only at the end of the dry season.

The beginning of the oak zone may be recognized by the appearance of *Quercus chihuahuensis* along the waterways and northeast slopes (Fig. 13). *Prosopis* and *Fouquieria* may still persist at this elevation (Fig. 12), but extend little above it. With increasing altitude other oaks, principally *Q. arizonica* and *Q. Emoryi*, appear and extend their domain to an ever greater extent over the hillsides. At 1300 m. as many as six species of oak can be found growing together. Scattered pine trees (*Pinus arizonica*, *P. cembroides*, *P. chihuahuana* and *P. ponderosa*) are first seen at about 1525 m (Fig. 23), and they rapidly increase in numbers until at 1800 m. their dominance over other trees marks the beginning of the pine forest.

The oak-grassland is relatively uniform throughout its extent; it lacks such diversities in composition and physiognomy as are presented in the lowland areas by the mesquite thickets and *Larrea* and cactus plains. The oaks which are consistently present, besides the three already mentioned, are *Q. oblongifolia*, *Q. vimineae* and *Q. hypoleucoides*. *Q. Toumeyi* is not so regularly found, but where present it may form dense thickets which give it the vernacular name of "encino chaparro". Other trees associated with the oaks are:

Juniperus Deppeana var. *pachyphloea*
J. flaccida
Prunus virens
Erythrina flabelliformis

Lysiloma microphylla
L. Watsoni
Sapindus Saponaria
Fraxinus Greggii

The following shrubs are the most common ones of the oak-grassland. Those preceded by an * show a preference for moist shady places:

Cassia leptocarpa
Eysenhardtia orthocarpa
Mimosa Wrightii
Acalypha papillosa
Manihot angustiloba
Rhus choriophylla
Dodonaea viscosa
**Rhamnus betulaeifolia*

Gossypium Thurberi
Hibiscus Coulteri
Zauschneria arizonica
**Mandevilla foliosa*
**Macrosiphonia brachysiphon*
Tecoma incisa
**Bouvardia glaberrima*
Randia Watsoni

Dasyllirion (Fig. 12) and *Agave* (Fig. 20) are also common.

In the oak-grassland the grasses make their finest display, especially at elevations of 1300 to 1500 m. (Figs. 19, 12, and 13). Extensive

grassy plains, affording excellent grazing, exist at Carretas, La Nacha, and to a lesser degree at Huépari and Piedra Parada. Numerous species grow on these plains, but the most important ones belong to the genera *Bouteloua*, *Muhlenbergia* and *Aristida*. A partial list of the grasses collected at these four places, chiefly by Harvey and Santos, reveals the richness of the grass flora:

<i>Aegopogon tenellus</i>	<i>Eriochloa aristata</i>
<i>Andropogon barbinodis</i>	<i>Heteropogon contortus</i>
<i>A. cirratus</i>	<i>H. melanocarpus</i>
<i>Aristida Adscensionis</i>	<i>Leptochloa filiformis</i>
<i>A. Schiedeana</i>	<i>Lycurus phleoides</i>
<i>A. ternipes</i>	<i>Muhlenbergia arizonica</i>
<i>Bouteloua aristoides</i>	<i>M. ciliata</i>
<i>B. chondrosioides</i>	<i>M. Emmersleyi</i>
<i>B. curtispindula</i>	<i>M. monticola</i>
<i>B. glandulosa</i>	<i>M. pauciflora</i>
<i>B. hirsuta</i>	<i>M. texana</i>
<i>B. radicata</i>	<i>Panicum bulbosum</i>
<i>B. Rothrockii</i>	<i>P. dichotomiflorum</i>
<i>Bromus frondosus</i>	<i>P. hirticaule</i>
<i>Chloris virgata</i>	<i>Pappophorum Wrightii</i>
<i>Echinochloa colonum</i>	<i>Setaria Grisebachii</i>
<i>Elyonurus barbiculmis</i>	<i>S. macrostachya</i>
<i>Eragrostis cilianensis</i>	<i>Sporobolus microspERMUS</i>
<i>E. diffusa</i>	<i>Trachypogon Montufari</i>
<i>E. intermedia</i>	<i>Trichachne californica</i>
<i>E. neomexicana</i>	<i>T. insularis</i>
	<i>Tripsacum lanceolatum</i>

Among the herbs, other than grasses, it is to be noted that a number of families, rare or absent in the lowlands, becomes conspicuous in the oak-grassland, and many of the species which first appear in this zone extend upward into the pine forest. The most prominent of these families are the *Polypodiaceae*, *Cochlospermaceae*, *Geraniaceae*, *Labiatae* and *Scrophulariaceae*. Similarly, the herbaceous genera of the *Leguminosae* are infrequent in the lowlands, but common at higher altitudes.

Some of the more common herbs of the oak-grassland are listed below:

<i>Adiantum Capillus-Veneris</i>	<i>Clematis Drummondii</i>
<i>Asplenium Palmeri</i>	<i>Heuchera sanguinea</i>
<i>A. Trichomanes</i>	<i>Cassia leptocarpa</i>
<i>Bommeria hispida</i>	<i>C. Wrightii</i>
<i>Cheilanthes Lindheimeri</i>	<i>Crotalaria longirostrata</i>
<i>Ch. Pringlei</i>	<i>C. sagittalis</i>
<i>Selaginella rupincola</i>	<i>Dalea diffusa</i>
<i>Ch. Wrightii</i>	<i>D. Lumholtzii</i>
<i>Notholaena aurea</i>	<i>Desmodium batocaulon</i>
<i>N. Grayi</i>	<i>D. neomexicanum</i>
<i>N. sinuata</i>	<i>D. cinerascens</i>
<i>Pellaea Wrightiana</i>	<i>Lotus puberulus</i>
<i>Woodsia mexicana</i>	<i>Nissolia Schottii</i>
<i>Tillandsia recurvata</i>	<i>Phaseolus heterophyllus</i>
<i>Commelina crispa</i>	<i>Krameria Grayi</i>
<i>Tradescantia pinetorum</i>	<i>K. parvifolia</i>
<i>Anthericum Torreyi</i>	<i>Linum neomexicanum</i>
<i>Milla biflora</i>	<i>Kallstroemia grandiflora</i>
<i>Allionia incarnata</i>	<i>Aspicarpa hirtella</i>
<i>Boerhaavia caribaea</i>	<i>Polygala hemipterocarpa</i>
<i>B. erecta</i>	<i>P. obscura</i>
<i>Portulaca suffrutescens</i>	<i>Cnidioscolus angustidens</i>

<i>Euphorbia heterophylla</i>	<i>Verbena bipinnatifida</i>
<i>E. hirta</i> var. <i>typica</i>	<i>V. ciliata</i>
<i>Jatropha macrorrhiza</i> var. <i>septemfida</i>	<i>Hedeoma oblongifolium</i>
<i>Kosteletskyia Thurberi</i>	<i>Monarda austromontana</i>
<i>Ayenia pusilla</i>	<i>Stachys coccinea</i>
<i>Waltheria americana</i>	<i>Gerardia Wrightii</i>
<i>Amoreuxia palmatifida</i>	<i>Castilleja tenuiflora</i>
<i>Passiflora bryonioides</i>	<i>Houstonia Wrightii</i>
<i>Cuphea Wrightii</i>	<i>Ageratum corymbosum</i>
<i>Prionosciadium Watsoni</i>	<i>Bidens pilosa</i>
<i>Amsonia pogonosepala</i>	<i>Coreocarpus arizonicus</i> var. <i>pubescens</i>
<i>Asclepias glaucescens</i>	<i>Erigeron neomexicana</i>
<i>Gonolobus productus</i>	<i>Guardiola platyphylla</i>
<i>Evolvulus alsinoides</i>	<i>Heliopsis parvifolia</i>
<i>E. arizonicus</i>	<i>Hymenothrix Wislizeni</i>
<i>Ipomoea ancisa</i>	<i>Melampodium appendiculatum</i>
<i>I. costellata</i>	<i>Pectis prostrata</i>
<i>Gilia Pringlei</i>	<i>Zexmenia podocephala</i>
<i>Bouchea prismatica</i> var. <i>brevirostris</i>	<i>Zinnia multiflora</i>

A special habitat within the oak-grassland zone which should be mentioned is Cañón de Santa Rosa, a few kilometers east of El Tigre. Here there are limestone deposits, and among the plants collected on this site *Bumelia rigida*, *Cheilanthes leucopoda*, *Heckia montana*, *Mortonia scabrella* and *Tragia laciniata* were found nowhere else, indicating the possibility of a soil factor limiting their distribution in this area. Except for the above six species the vegetation on limestone soil was in no way exceptional.

The highest elevation in the oak-grassland from which extensive collections are available is Rancho Carretas, Chihuahua. Although physiographically not a part of the Bavispe River system, as its drainage is toward the northeast, ending in Lake Guzmán, the vegetation is the same as that found on the west side of the Continental Divide. It is to be noted here that many of the lowland species which persist into the oak-grassland appear to reach their upper limit at this elevation (1470 m.). Some of these are:

<i>Chilopsis linearis</i>	<i>Gutierrezia lucida</i>
<i>Aster tagetinus</i>	<i>Ipomoea costellata</i>
<i>Baccharis glutinosa</i>	<i>Sphaeralcea Fendleri</i>
<i>Boerhaavia erecta</i>	<i>Datura meteloides</i>
<i>Commicarpus scandens</i>	<i>Celtis reticulata</i>

Numerous others, especially grasses, might be mentioned, but they can be identified by referring to the Table of Altitudinal Distribution in the Appendix.

The position of the Carretas grasslands is indicated on many maps by the name "Llanos de Carretas". My 1938 collections, and those of Harvey and myself of 1939, were made in the southern portion of the grassland area, in the immediate vicinity of the ranch and the Sierra Madre. The open grassland is therefore limited to the valley of the Arroyo Carretas, and the hills and mountains are covered with oak, juniper and, at high levels, pine.

Perhaps forty species of grass grow here, belonging for the most part

to the genera *Bouteloua*, *Aristida*, *Muhlenbergia* and *Eragrostis*. The commonest species are:

<i>Bouteloua gracilis</i>	<i>Aristida ternipes</i>
<i>B. barbata</i>	<i>A. Adscensionis</i>
<i>B. aristidoides</i>	<i>A. barbata</i>
<i>B. curtipendula</i>	<i>A. Schiedeana</i>
<i>B. radicata</i>	<i>Muhlenbergia arizonica</i>
<i>B. hirsuta</i>	<i>M. montana</i>
<i>Eragrostis cilianensis</i>	<i>M. Emmersleyi</i>
<i>E. neomexicana</i>	<i>Panicum hirticaule</i>
<i>E. diffusa</i>	<i>P. bulbosum</i>
<i>E. intermedia</i>	<i>P. arizonicum</i>
<i>Cenchrus pauciflorus</i>	<i>Hilaria mutica</i>
<i>Leptochloa dubia</i>	<i>Lycurus phleoides</i>

The herbs associated with the grasses are those common elsewhere in this zone, namely various species of *Ipomoea*, *Boerhaavia*, *Gomphrena*, prostrate *Euphorbiae*, *Desmodium*, *Dalea*, *Verbena*, *Argemone*, and several genera of *Compositae*.

On rocky hills occur a few cacti of the genera *Opuntia*, *Echinocereus* and *Mammillaria*. These, like *Agave* and *Dasyliirion* which also persist to this altitude, are much less frequent than at lower elevations.

Pine Forest

I place the beginning of the pine forest at an elevation of from 1800 to 1900 m. although Shreve (43) and Brand (8) consider the lower edge of the pine forest, in western Chihuahua, to be 2100 m. Shreve recognizes, however, that west of the continental divide the pine forest descends to 1800 m. and a mixture of pine and oak is found as low as 1525 m. (Fig. 23). Gentry (14) considers that in southern Sonora the pine forest extends from 1525 to 2750 m.

The pine forest in the Sierra del Tigre is characterized by the presence of five species of pine which occur in places in nearly pure stands, and elsewhere in mixture with oak, *Arbutus*, *Pseudotsuga* and *Juniperus*. The five pines are:

<i>Pinus ponderosa</i>	<i>P. chihuahuana</i>
<i>P. arizonica</i>	<i>P. Ayacahuite</i> var. <i>brachyptera</i>
	<i>P. cembroides</i>

The common oaks in the pine zone are *Quercus arizonica*, *Q. Emoryi*, *Q. hypoleucoides*, *Q. diversicolor*, *Q. oblongifolia* and *Q. viminea*. At the higher elevations *Q. hypoleucoides* and *Q. diversicolor* are more regularly present than the other species. A rare oak, *Q. albaefolia*, was collected in three different places at elevations of 1860 to 2310 m.

The best stands of pine occur on relatively level areas, either on plateaus, or in broad and shallow valleys. Such a forest has a park-like appearance (Fig. 25), with a thin understory of oak, *Cercocarpus eximius*, *Prunus virens*, *Rhus trilobata*, and *Spiraea dumosa*.

The herbaceous flora is surprisingly rich, and many of the most attractive flowers of the whole region are to be found in the pine zone. The characteristic species are:

Pteridium aquilinum
Agropyron arizonicum
Blepharoneuron tricholepis
Bromus anomalus
Tigridia Pringlei
Malaxis corymbosa
Silene laciniata
Agrimonia striata
Potentilla atrorubens
Cologania angustifolia
C. Lemmonii

Vicia pulchella
Helianthemum majus (rare)
Begonia Martiana
Chimaphila maculata (rare)
Macromeria Thurberi
Cosmos crithmifolius
C. parviflorus
Pinaropappus roseus
Stevia Palmeri
Viguiera cordifolia
Xanthocephalum Wrightii

Also to be found are many species of the oak-grassland, including *Commelina crispa*, *Tradescantia pinetorum*, *Anthericum Torreyi*, *Milla biflora*, *Gilia Pringlei*, *Monarda austromontana*, etc.

On hillsides oak is generally more abundant than pine, and may be dense enough to bring about impoverishment of the ground cover by shading (Fig. 24).

The pine cover is sparse or absent on rocky ridges and other places where the soil is shallow. The vegetation on such sites may consist of a thin stand of grasses cacti and other herbs, or there may be open to dense thickets of oak, juniper, *Garrya*, *Arctostaphylos* and *Cercocarpus*.

The high mountain meadows (Fig. 14) have an assemblage of plants which differs little in composition from the herbaceous vegetation of the drier pine slopes yet it has a distinctive appearance because of the denser growth and the greater abundance of a few showy species. More than any other single plant, *Oenothera Hookeri* var. *irrigua* sets the meadow off from the adjacent vegetation, but besides this *Geranium atropurpureum*, *G. Wislizeni*, *Verbena ciliata*, *Centaurea americana* and sedges and rushes contribute to the distinctive appearance of this habitat. Below is a complete list of the plants collected in a meadow near Las Tierritas, located a few kilometers south of El Tigre at an elevation of about 1850 m. Only the plants mentioned above are omitted.

Polygonum aviculare
Rumex crispus
R. salicifolius
Chenopodium Berlandieri
Amaranthus hybridus
Mirabilis Jalapa
Agrimonia striata
Potentilla atrorubens
Cologania angustifolia
C. Lemmonii
Lotus chihuahuensis
Cosmos parviflorus
Erigeron canadensis
E. delphinifolius
Galinsoga parviflora
Hieracium Fendleri

Phaseolus dilatatus
Trifolium lacerum
Vicia pulchella
Eryngium Lemmonii
Gilia Pringlei
Monarda austromontana
Salvia Townsendii
Datura quercifolia
Castilleja patritica
Penstemon barbatus
Bahia chrysanthemoides
Stevia Palmeri
S. salicifolia
Tagetes micrantha
Xanthocephalum Wrightii
Zinnia multiflora

Pseudotsuga is usually found only in deep well watered canyons and on northeast slopes (Fig. 26). There are therefore no large stands of this tree, but where conditions are favorable they reach a large size and form a dense cover. At the head of the Cañón de Bavispe a small stand of Douglas fir occupies a deep and narrow ravine where high cliffs afford protection from winds and the afternoon sun. A number of springs keep the ground well watered and the atmospheric humidity

high enough to support a heavy growth of *Tillandsia* on the trees. The following plants were collected in this habitat:

Polypodium erythrolepis
Smilacina racemosa
Malaxis corymbosa
Heuchera sanguinea
Begonia Martiana

Aralia humilis
Polemonium pauciflorum
Phacelia platycarpa
Solanum tuberosum var. *boreale*
Lonicera arizonica
Cacalia decomposita

This site is our only station for the *Polypodium*, *Smilacina* and *Polemonium*.

At a place called Puerto de los Aserraderos, west of Bavispe, Phillips and I had an opportunity to collect on an area which had been severely burned the year before. The large pine trees survived the fire, but most of the oaks were killed and at the time of our visits (June and August, 1940) were already sending up root sprouts. The fire appeared to favor a number of species, for a great abundance of *Lotus puberulus*, *Verbena ciliata* and *Bouvardia glaberrima* was noted on burned areas as compared with the undisturbed forest. On the other hand *Geranium Wislizeni*, *Gilia Pringlei*, *Gerardia Wrightii* and *Milla biflora* were not found and presumably had been eliminated.

Our highest collecting station is Picacho del Pilar, which rises abruptly from the Bavispe River southwest of Colonia Oaxaca to a height of 2310 m. On the exceedingly steep slopes of the upper portion of this peak the pine forest gives way to oak except in canyons with a north or northeast exposure; this I attribute to the rapid run-off and consequent low moisture content of the soil.

The oaks present on the Picacho are *Quercus arizonica*, *Q. diversicolor*, and *Q. albaefolia*. *Q. hypoleucoides* is to be expected but it was not seen. *Arctostaphylos pungens*, *Ceanothus Huichagorare* and *Cercocarpus eximius* likewise still persist at this altitude, and in places are abundant. A single specimen of *Opuntia* was taken at an elevation of 2100 m. and this genus is thus represented at all elevations in this area. Other plants collected from 2100 m. and higher are:

Pteridium aquilinum
Juniperus sp.
Cyperus aristatus
C. Fendlerianus
Commelina sp.
Tradescantia sp.
Anthericum Torreyi
Hypoxis sp.
Chenopodium incisum
Penstemon Torreyi
Diodia teres var. *angustata*
Valeriana sorbifolia
Artemisia Ludoviciana
Bidens leptoccephala
Heterospermum pinnatum

Drymaria effusa
Sedum sp.
Spiraea dumosa
Phaseolus heterophyllus
Lopezia gracilis
Pterospora Andromedae
Gentiana microcalyx
Salvia sp.
Castilleja laxa
Malacothrix saxatilis
Schkuhria Wislizeni
S. Wrightii
Senecio Hartwegi
Stevia salicifolia
Viguiera longifolia

Silene laciniata and *Quamoclit coccinea* were seen here but not collected; the latter is noteworthy because it is one of the few species present at all altitudes in this area.

Santos collected the following grasses:

Aegopogon tenellus
Agropyron arizonicum
Andropogon cirratus
A. hirtiflorus
Aristida divaricata
A. Schiedeana
Blepharoneuron tricholepis
Bromus anomalus
Chloris submutica
Koeleria cristata
Muhlenbergia Emmersleyi

Muhlenbergia longiligula
M. montana
M. pauciflora
M. polycaulis (?)
M. pusilla
M. rigida
M. texana
Panicum bulbosum
Piptochaetium fimbriatum
Sporobolus ramulosus
Stipa Pringlei

Riparian Vegetation

The banks of the Río de Bavispe support a fringe of vegetation very much like that found in similar situations throughout northern Mexico. The cottonwoods and willows (Fig. 9) which mark the course of the river are among the largest trees of the region, being equaled or exceeded in height only by the pines and Douglas fir. Despite the fine appearance of the shore vegetation from a distance, on closer examination it is found to be for the most part of a weedy character, with monotonous stretches of *Baccharis glutinosa*, *Hymenoclea monogyra*, *Nicotiana glauca*, and *Ricinus communis*, together with scattered trees of *Juglans major*, *Chilopsis linearis*, *Celtis pallida*, *C. reticulata*, *Prosopis* and *Acacia Greggii*. *Clematis Drummondii* is sure to be found here, and other undergrowth is composed of *Ambrosia aptera* (in shady spots), *Amaranthus*, *Datura*, *Croton texensis*, *Quamoclit coccinea*, *Ipomoea*, *Portulaca*, *Euphorbia*, *Acalypha*, *Chenopodium*, *Boerhaavia* and other species common in the mesquites.

Canyon Vegetation

The well watered upper parts of the larger canyons have a characteristic vegetation which, because of the special conditions prevailing in them, cuts across the vegetational zones described above. Permanent running water is found from the pine zone down to the upper part of the oak zone, and a high water table, as evidenced by numerous pools in the canyon bottom, persists to near the upper border of the mesquite-grassland.

In such a habitat the characteristic trees are *Juglans major*, *Platanus Wrightii*, *Sapindus Saponaria*, *Acer brachypterum*, *Alnus oblongifolia*, *Ostrya virginiana* and *Fraxinus velutina*. At low elevations the oaks also make their first appearance in the canyons and with increasing gradually extend their area, first on northern slopes and finally over all exposures. *Ungnadia speciosa* was found in only two places: Arroyo del Púlpito and Cañón de la Bellota.

The herbaceous plants which are confined to the canyons are few in number. *Begonia Martiana* is undoubtedly more definitely restricted to a canyon habitat than any other plant in the area. It is to be looked for on shady ledges or even in rock crevices in vertical canyon walls, but an abundant water supply and a relatively high atmospheric humidity are required. Since these conditions are not found at low elevations *Begonia Martiana* is present only in the oak-grassland and pine zones, and is more abundant in the latter. It is probably resistant to light frosts.

Among the other plants to be expected in the canyons the following must be mentioned: *Adiantum Capillus-Veneris*, *Phanerophlebia auriculata*, *Thalictrum Fendleri*, *Mimulus* spp., *Mirabilis Wrightiana*, *Heuchera sanguinea*, *Geranium atropurpureum*, *G. Wislizeni*, *Ayenia pusilla*, *Cuphea Wrightii*, *Lopezia gracilis*, *Gilia formosissima*, *Agastache Barberi*, *Galium* spp., *Lonicera cerviculata*, *Lobelia cardinalis*, and *Senecio Hartwegi*.

With the exception of the genus *Cheilanthes* most ferns show a preference for a canyon habitat. Whitehead (60) and Wiggins (61) have described the habitats of some of the ferns occurring in the Sonoran desert and their account, except for some of the associated plants, would serve very well for many of the canyons of the Sierra del Tigre.

The dry lower portion of the canyons requires little comment for here the vegetation scarcely differs from that of the mesquite-grassland. Present here are: *Chilopsis linearis*, *Celtis pallida*, *Tecoma incisa*, *Dodonaea viscosa*, *Rhus microphylla*, *Rhus Rydbergii*, *Pithecolobium mexicanum*, *Acaciae* and *Mimosae*. *Populus*, *Salix*, *Baccharis* and other elements of the riparian vegetation may also be present.

UTILIZATION OF NATURAL RESOURCES

Throughout the area under consideration grasses constitute one of the principal natural resources and the raising of livestock has a corresponding importance. Although in the mesquite-grassland good forage grasses are not abundant, especially during the dry season, mesquite and other browse plants supplement the diet of cattle and other grazing animals. Along the larger streams, such as the Bavispe, Fronteras and San Bernardino Rivers with their fringe of permanently green vegetation, are located the most prosperous of the lowland cattle ranches.

The most favorable conditions for the grazing industry are found in the oak-grassland zone which has extensive areas of unbroken grasslands (Figs. 19, 12 and 13), abundant water and a temperate climate. The best examples of cattle ranches in this zone are La Nacha, Huépari and Carretas, Chihuahua.

A single example of a dairy business came to my attention. At La Nacha a score or so of cows were milked daily and the milk sent to La Angostura which then had a large transient population engaged in the construction of an irrigation dam.

At higher elevations grazing is of minor importance, although in places the cattle are moved into the pine zone during the rainy months in order to conserve the lower grazing lands for the dry season.

Agriculture is practised only on a small scale, mainly on the alluvial land of the river bottom. The area suitable for cultivation is severely limited as in many places the river passes through narrow rocky gorges. The mainstay of the local diet, as throughout Mexico, is corn and beans. These are likewise the principal crops, but each family commonly cultivates a small plot of vegetables, the most common ones being peppers, squash, watermelons, cantaloupes and tomatoes. Near Huachinera and Bacerac there are peach and apple orchards, but the people in general are accustomed to eating little fruit and most of that is wild (e.g. tuna, pitaya, garambullo etc.).

A minor crop is wheat, which finds its way to a small flour mill at Colonia Morelos. Cotton culture was at one time attempted near Colonia Morelos, but according to the inhabitants it was not successful because of insect pests.

The construction of a dam at La Angostura, north of Oputo, makes it possible to irrigate much of the valley land below this point.

A sawmill located in the pine zone at Las Tierritas is the only commercial form of forest exploitation. Its products find an outlet through El Tigre.

A clandestine and illicit activity carried out in certain sections is the distillation of mescal from roasted *Agave* stumps. The Cañón de la Mescalera appears to have been named for some rustic stills once in use there. The leaves of the *Agave* are used to some extent for manufacturing rope.

Since the Opata Indians who originally inhabited the Río Bavispe region have long since lost their tribal identity their manner of using the native plants is virtually unknown. For an account of the ethnobotany of the neighboring tribes the reader is referred to the works of Bennett and Zingg (5), Castetter and Underhill (10), Studhalter (50) and Wagner (57).

PHYTOGEOGRAPHY AND FLORAL RELATIONSHIPS OF THE REGION

Local Distribution of Plants

In plotting the stations where different species of plants were collected within the loop of the Bavispe River, it will readily be observed that the plants of the three life zones have a more or less concentric distribution pattern; i.e. plants of the mesquite-grassland follow the course of the river as far as Huachinera. Oak-grassland plants in turn are present chiefly between the 1000 and 1800 m. contours and, finally, the highland species are restricted to a narrow band extending from near El Bilito southward to near the latitude of Horconcos. Examples of these distribution patterns are shown in Figs. 1-8.

Not all plants can be placed definitely in one or another life zone; many of the common ones are found almost throughout the area and seem little restricted by habitat requirements. Here belong the cosmopolitan weeds *Digitaria sanguinalis*, *Eragrostis cilianensis*, *E. intermedia*, *Solanum nigrum*, *Verbena carolina*, *Quamoclit coccinea* and *Aster exilis*.

On the contrary, there are plants which occur only in a small part of a single zone. Thus the only palm in the area, *Washingtonia Sonorae*, was seen only in Cañón del Temblor, C. de la Gallina and along the road between La Angostura and La Nacha (Fig. 21). While it is very likely present in other canyons on the western side of the Sierra del Tigre, it is entirely absent on the eastern side. The place name La Palmita, west of Bacadéhuachi, may indicate the presence of this palm in that vicinity, but it was not seen there.

Other species which have a restricted distribution within a single zone are: *Cathastecum erectum*, collected only in the lowlands from Colonia Morelos southward to Oputo; *Eragrostis neomexicana*, found only in the vicinity of Huépari; *Piptochaetium fimbriatum*, from the vicinity of El Tigre, El Roble and El Bilito; *Triodia mutica*, found at San Rafael and near Colonia Morelos; and *T. pulchella*, with a similar



FIGS. 1-4. Distribution patterns of species characteristic of the three major vegetational types. The mesquite-grassland extends along the Río de Bavispe to Huachinera; the oak-grassland represents a belt between 1000 and 1800 m. elevations; the highland species occupy a narrow strip above 1800 m. elevation ranging between El Bilito and Horconcitos. For details see pages 237-251.



FIGS. 5-8. Distribution patterns of species characteristic of the three major vegetational types. The mesquite-grassland extends along the Río de Bavispe to Huachinera; the oak-grassland represents a belt between 1000 and 1800 m. elevations; the highland species occupy a narrow strip above 1800 m. elevation ranging between El Bilito and Morconcitos. For details see pages 237-251.

distribution. Although it may be argued that the apparent restricted distribution of these plants is due to the accidents of collection, the above examples were selected with a view to reducing that possibility as much as possible. Since two agrostologists were in the field with me, the *Gramineae* were probably more thoroughly collected than any other large family; furthermore the above plants, all from the western side of the Sierra del Tigre, could hardly have escaped notice on the eastern side if they had been present there, for much the greater part of the collecting was done on the eastern slopes.

The plants of the Sinaloan province have already been mentioned. Most of them apparently reach their northern limit near the latitude of Moctezuma and Bacadéhuachi. Unless it be assumed that these species are still extending their range northward, this line seems best interpreted as a climatic barrier beyond which they cannot pass. Shreve (40) and later Turnage and Hinckley (53) have shown the effect of frost in limiting the distribution of plants, but it cannot be stated now whether it is frost or some other climatic barrier operating in this case.

Relationships of the Flora

Of the 1200 species and varieties of plants recorded here approximately 90% are listed in "Flowering Plants and Ferns of Arizona" (21). Since all of my collecting was carried out within 175 km. of the border and most of it within 140 km. it is not surprising that only a small percentage of the plants collected should not be known in that state. The plants not reported from Arizona, numbering 150 species, are distributed among 43 families. Three of these, the Begoniaceae, Bombacaceae and Cistaceae are not represented at all in either Arizona or New Mexico (21-51).

With respect to their areas of distribution the plants of northeastern Sonora may be grouped into the following geographical categories: 1, endemic; 2, north Mexican Pacific slope; 3, Sierra Madre; 4, Central Plateau; 5, western United States; 6, eastern United States; 7, continental; 8, tropical; and 9, plants with anomalous distribution. Some plants with peculiar ranges must be assigned rather arbitrarily to one or another of the above groups, but generally speaking there is little difficulty in determining where a given plant belongs.

As these categories include plants of similar distribution, but not necessarily of similar ecological requirements, the terms adopted appear suitable in that they imply nothing as to habitat. Each of these groups is discussed below.

1. *Endemic Plants*.—Here are placed the species known to occur only in the highland area of southwestern New Mexico, southeastern Arizona, eastern Sonora and western Chihuahua.⁷ So far as is known they are not found beyond the limits of the Apachian biotic province. The least known species are those which have recently been described as new: *Eriosaema laetum* (19), *Phacelia heterophylla* var. *sonorensis*,

⁷Distribution data were taken from Kearney and Peebles (21), Robinson and Fernald (32), Small (45), Standley (46), Tidestrom and Kittell (51), and various monographs. In some cases herbarium specimens were consulted for supplementary information.



FIG. 9 (upper). River-bank vegetation near Colonia Morelos consisting of *Populus*, *Salix*, *Nicotiana glauca*, *Baccharis glutinosa* and other plants mentioned in text.

FIG. 10 (center). *Koeberlinia spinosa* in *Larrea* association about 5 km. east of Colonia Morelos.

FIG. 11 (lower). Overgrazed and eroded slopes above Cañón de Bavispe. The slopes have a sparse cover of grass and weeds; on the talus slopes and walls of the canyon are found *Haplophyton cimicifidum*, *Ipomoea* spp., *Cassia* spp., *Hibiscus denudatus* var. *involucellatus*, *Dodonaea viscosa* and others.

Penstemon campanulatus var. *subglandulosus* and *Lonicera cervicalata* (59). These have been collected only in the Bavispe River region. *Ipomoea Lemmonii*, also found here, was previously known only from the Huachuca Mountains of Arizona (21, 51). Other more wide-ranging species are:

Cheilanthes Pringlei
Polypodium erythrolepis
Agave Hartmani
Quercus albaefolia
Q. chihuahuensis
Silene Thurberi
Ranunculus arizonicus
Cassia Wrightii
Desmanthus bicornutus

Indigofera sphaerocarpa
Mimosa Grahami
Euphorbia Plummerae
Agastache Barberi
Salvia Parryi
Cacalia decomposita
Hieracium Lemmonii
Schkuhria Wislizeni
S. Wrightii

2. *Plants of the North Mexican Pacific Slope.*—The northern Pacific slope of Mexico, including Baja California, southeastern California and southwestern Arizona, corresponds rather closely with Ochoterena's north Sinaloan and west Sonoran arid sub-region (30), with Dice's Sonoran and Sinaloan biotic provinces (11), and with Atwood's Sonoran physiographic province (1.) Much of this area is arid or semi-arid, and the plants which enter northeastern Sonora from the west or southwest for the most part belong to the hot dry lowlands. Nevertheless, there are a few which I found either in part or exclusively in the oak-grassland zone, and at least two (*Verbena neomexicana* var. *xylopoda* and *Metastelma Watsonianum*) extend upward into the pine zone.

The following are the species collected in the Bavispe River area whose range, so far as known, does not extend beyond the north Mexican slope region:

Pityrogramma triangularis
Bouteloua Rothrockii
Eriochloa aristata
Muhlenbergi dumosa
Washingtonia Sonorae
Hechtia montana
Salix jaliscana
Alnus oblongifolia
Ficus petiolaris
Boerhaavia Coulteri
Phaulothamnus spinescens
Crossosoma Bigelovii
Acacia cymbispina
Dalea Grayi
D. mollis
D. Parryi
Lysiloma Watsoni
Nissolia Schottii
Krameria parvifolia
Esenbeckia Hartmanii
Bursera laxiflora

Janusia californica
Acalypha papillosa
Cnidioscolus angustidens
Jatropha cordata
Rhamnus illicifolia
Abutilon Sonorae
Gossypium Thurberi
Kosteletskya Thurberi
Fouquieria Macdougalii
Echinocereus rigidissimus
Opuntia arbuscula
Bumelia occidentalis
Buddleia Wrightii
Stemmadenia tomentosa var. *Palmeri*
Matelea tristiflorum
Metastelma Watsonianum
Ipomoea Gentryi
Verbena neomexicana var. *xylopoda*
Aster aquifolius
Bidens Gentryi
Milleria quinqueflora

3. *Plants of the Sierra Madre.*—The ranges of the plants placed here fall largely within Ochoterena's Sierra Madre region, Dice's Apachian, Durangan and Potosian biotic provinces, and Atwood's Western, Southern and Eastern Sierra Madre physiographic provinces. Dice does not define the southern borders of his Durangan and Potosian provinces, but it must be assumed that they have a common boundary



FIG. 12 (upper). Grassland at Puerto del Cumarito, elev. 1650 m. Besides grasses some of the plants collected and observed here are *Fendlera Wrightii*, *Garrya Wrightii*, *Eysenhardtia orthocarpa*, *Quercus Emoryi*, *Q. oblongifolia*, *Dasyllirion Wheeleri*, *Nolina microcarpa*, *Polanisia uniglandulosa*, *Haplopappus laricifolius*, *Brickellia californica*, *Gilia Pringlei* and *Bowardia glaberrima*. *Fouquieria splendens* here reaches its upper limit.

FIG. 13 (center). Lower margin of the oak-grassland with some juniper; elev. 1390 m. Compare Fig. 19 from the same area.

FIG. 14 (lower). Wet meadow in the pine zone at El Bilito; elev. 1890 m.

in the southern Sierra Madre unless another intervening biotic province is to be recognized.

The plants of the Sierra Madre region are of course associated with pine and oak forests. The species with which we are here concerned are for the most part restricted to the Sierra Madre Occidental, yet there are a number of plants which are also present in the eastern Sierra Madre, or at least are represented there by a closely related form. Some members of this group extend southward to southern Mexico or even Guatemala (e.g. *Phacelia platycarpa*) and presumably the other species have, or at one time had, a similar connecting link between the two extremes of their ranges.

Illustrations of this type of distribution are found in Epling's monograph of the genus *Salvia* (12). *Salvia pinguifolia*, according to his distribution map, is found in southeastern Arizona, southern New Mexico and in the Sierra Madre of Chihuahua, while the closely related *S. ballotaeflora* ranges from south central Texas to Hidalgo. *S. microphylla* of the southern Sierra Madre is represented in the Sierra Madre Oriental by var. *neurepia* and in the Sierra Madre Occidental by var. *Wislizeni*. *S. Seemanii* occurs only in the western Sierra Madre, but the section *Angulatae* to which it belongs is well represented in eastern and southern Mexico, as well as in Central America. In other plant families, *Selaginella novoleonensis*, *Polypodium polypodioides*, *Tigridia Pringlei*, *Rhamnus betulaeifolia* and *Penstemon campanulatus* are examples of this same type of distribution. *Ostrya virginiana* might also be mentioned here (15, 59), but this species will be included among those of the eastern United States.

That the Sierra Madre serves as a highway for plant migration is indicated by the presence in northeastern Sonora of the following species, the ranges of which lie principally in southern Mexico:

<i>Muhlenbergia pusilla</i>	<i>Acacia filicoides</i>
<i>Salix jaliscana</i>	<i>Lysiloma microphylla</i>
<i>Mahonia trifolia</i>	<i>Stevia salicifolia</i>
	<i>Zexmenia ceanothifolia</i>

Of the above, only the last named species was collected by Gentry (14) in the Rio Mayo valley of southern Sonora.

Other plants belonging to the Sierra Madre region are:

<i>Asplenium Palmeri</i>	<i>Tephrosia leiocarpa</i>
<i>Cheilanthes pyramidalis</i>	<i>Cuphea Wrightii</i>
<i>Pinus ayacahuite</i> var. <i>brachyptera</i>	<i>Eryngium heterophyllum</i>
<i>Anthericum Torreyi</i>	<i>Arbutus arizonica</i>
<i>Malaxis corymbosa</i>	<i>Arctostaphylos pungens</i>
<i>Quercus Endlichiana</i>	<i>Halenia recurva</i>
<i>Q. fulva</i>	<i>Castilleja laxa</i>
<i>Cologania Lemmonii</i>	<i>C. patriotica</i>
<i>Desmodium arizonicum</i>	<i>Gerardia Wrightii</i>
<i>D. batocaulon</i>	<i>Lamorouxia viscosa</i>
<i>D. cinerascens</i>	<i>Penstemon campanulatus</i>
<i>D. gramineum</i>	<i>Bouvardia glaberrima</i>
<i>D. Rosei</i>	<i>Lobelia laxiflora</i>
<i>Diphysa Thurberi</i>	<i>Aspilia stenophylla</i>

4. *Plants of the Central Plateau.*—The Central Plateau area, wherein many plants of northeastern Sonora have the principal part of their geographical range, includes the Northern or Texano-Mexican subregion of Ochoterena, Dice's Chihuahuan Biotic Province, together



FIG. 15 (upper left). Dry arroyo 10 km. east of Agua Prieta on road to Colonia Morelos. *Rhus microphylla* and *Sporobolus Wrightii* on left; *Chilopsis linearis* on the right.

FIG. 16 (upper right). *Lemaireocereus Thurberi* 15 km. west of La Angostura. Trees in background are mesquite and palo verde; a cholla is in the foreground.

FIG. 17 (lower left). *Cereus Greggii*, showing massive storage root. Colonia Morelos.

FIG. 18 (lower right). *Opuntia fulgida* from Mesa de las Carreras, west of Colonia Morelos.

with portions of neighboring provinces to the north and west, and Atwood's Mexican Plateau and Colorado Plateau Physiographic Provinces. Considered as a whole, this is a region of medium elevation, characterized by an arid or semiarid climate and its corresponding type of vegetation. As in the case of the Pacific slope, the Central Plateau contributes mainly to the lowland vegetation of northeastern Sonora, but a few (e.g. *Dasyllirion Wheeleri*, *Trichachne californica*, and *Vitis arizonica*) are present in the upland oak and pine zones.

The distribution of the plants in the following list is in general from west Texas to Arizona, or southeastern California, southward to Zacatecas, San Luis Potosi and Hidalgo; a few (e.g. *Fendlera rupicola*) extend northward into Colorado, and others are found as far south as Puebla or Oaxaca (e.g. *Cocculus diversifolius*, *Calliandra eriophylla*). There are other species, however, limited to northern Mexico and southwestern United States; *Bernardia myricaefolia*, *Baileya Thurberi*, *Eriogonum Abertianum*, *Polygala macradenia*, *Ungradiopsis speciosa* and *Bumelia rigida* are examples of this type of distribution.

The following are some of the more important representatives of the Central Plateau in northeastern Sonora:

<i>Cheilanthes leucopoda</i>	<i>Condalia lycioides</i>
<i>C. Lindheimeri</i>	<i>C. spathulata</i>
<i>Ephedra trifurca</i>	<i>Abutilon incanum</i>
<i>Aristida barbata</i>	<i>Hibiscus Coulteri</i>
<i>Bouteloua rigidisetia</i>	<i>H. denudatus</i> var. <i>involucellatus</i>
<i>Muhlenbergia Emmersleyi</i>	<i>Sida tragiæfolia</i>
<i>Triodia pulchella</i>	<i>Fouquieria splendens</i>
<i>Celtis pallida</i>	<i>Mentzelia asperula</i>
<i>Eriogonum Wrightii</i>	<i>M. hispida</i>
<i>Boerhaavia Torreyana</i>	<i>Bumelia rigida</i>
<i>Clematis Drummondii</i>	<i>Fraxinus Greggii</i>
<i>Acacia constricta</i>	<i>Coldenia canescens</i>
<i>A. vernicosa</i>	<i>Lippia lycioides</i>
<i>Cassia Wislizeni</i>	<i>L. Wrightii</i>
<i>Calliandra humilis</i>	<i>Priva mexicana</i>
<i>C. reticulata</i>	<i>Verbena Ehrenbergiana</i>
<i>Dalea diffusa</i>	<i>Lycium Berlandieri</i>
<i>Eysenhardtia orthocarpa</i>	<i>Nicotiana glauca</i>
<i>Mimosa biuncifera</i>	<i>Cucurbita digitata</i>
<i>Krameria Grayi</i>	<i>Ibervillea tenuisecta</i>
<i>Thryallis angustifolia</i>	<i>Lobelia fenestralis</i>
<i>Polygala scoparioides</i>	<i>Eupatorium Greggii</i>
<i>Croton corymbulosus</i>	<i>E. solidaginifolium</i>
<i>Rhus microphylla</i>	<i>Parthenium incanum</i>
<i>R. virens</i>	<i>Trixis californica</i>
	<i>Verbesina Rothrockii</i>

5. *Plants of the Western United States.*—This heading is used to designate a group of widespread plants with a generalized range extending from the Mississippi valley westward to the Pacific states, and from southwestern Canada southward to northern Mexico. There are a few plants which are distributed over much of this area; these are: *Marsilea vestita* (South Dakota to British Columbia and southward to Oklahoma, southern California and northern Mexico), *Bromus marginatus* and *Sitanion Hystrix* (South Dakota to British Columbia and southward to Arizona and northern Mexico), *Juncus interior* (Illinois and Missouri westward to Washington and southward to Arizona), *Commandra pallida* (Minnesota to British Columbia and southward



FIG. 19 (upper left). Open grassland above Cañón de la Bellota; elev. of foreground 1390 m. Plants present are *Quercus arizonica* (on slope in background), *Rhus choriophylla*, *Mahonia haematocarpa*, *Garrya Wrightii*, *Dasyllirion Wheeleri*, cacti and grasses.

FIG. 20 (upper right). *Agave Parryi* at La Nacha in the oak-grassland; elev. 1310 m. Shrub in right foreground is *Dodonaea viscosa*, a rare plant at this altitude; trees in background are oaks.

FIG. 21 (lower left). *Washingtonia Sonorae* 18 km. east of La Nacha near lower margin of the oak zone. This palm occurs only on the western slopes of the Sierra del Tigre and is of sporadic occurrence.

FIG. 22 (lower right). *Opuntia spinosior* at Sierra de la Cabellera, with *Quercus* in background.

to Texas and California) and *Atriplex canescens* (South Dakota to Oregon and southward to Baja California and Zacatecas).

However, most of these western plants fall into either an eastern or western subdivision, corresponding roughly to the Great Plains and Rocky Mountain regions. The plants of the eastern portion are:

<i>Paspalum stramineum</i>	<i>Gilia longiflora</i>
<i>Sporobolus texanus</i>	<i>Scutellaria resinosa</i>
<i>Commelina crispa</i>	<i>Chamaesaracha Coronopus</i>
<i>Populus acuminata</i>	<i>Physalis lanceolata</i>
<i>Erigonum Jamesii</i>	<i>Curcubita foetidissima</i>
<i>Froelichia gracilis</i>	<i>Cyclanthera dissecta</i>
<i>Portulaca suffrutescens</i>	<i>Berlandiera lyrata</i>
<i>Croton texensis</i>	<i>Chrysopsis villosa</i>
<i>Oenothera speciosa</i>	<i>Haplopappus spinulosus</i>
<i>Asclepias galioides</i>	<i>Verbesina encelioides</i>
<i>Convolvulus incanus</i>	<i>Zinnia grandiflora</i>

The following plants belong to the Rocky Mountain region, but some of them range westward to the Pacific states:

<i>Pinus ponderosa</i>	<i>Epilobium Drummondii</i>
<i>Pseudotsuga mucronata</i>	<i>Asclepias mexicana</i>
<i>Bromus polyanthus</i>	<i>Mimulus cardinalis</i>
<i>Juncus saximontanus</i>	<i>M. nasutus</i>
<i>Zygadenus paniculatus</i>	<i>Sambucus coerulea</i>
<i>Habenaria sparsiflora</i>	<i>Erigeron concinnus</i>
<i>Populus angustifolia</i>	<i>Gnaphalium chilense</i>
<i>Rhus trilobata</i>	<i>Gutierrezia Sarothrae</i>

6. *Plants of the Eastern United States.*—The plants grouped here have their main areas of distribution in the eastern United States, i.e. east of the Mississippi River. Some of those listed below, however, range westward as far as North Dakota (*Eragrostia pectinacea*), Nebraska (*Panicum dichotomiflorum*), Utah (*Euphorbia dentata*), Colorado (*Phalaris caroliniana*), Texas (*Ostrya virginiana*) and Arizona (*Phytolacca americana*). The distribution of some of the others, in the United States, is restricted to the southeastern states, with the northern limit varying from the Gulf States to the latitude of Virginia and Delaware. The species considered to be typically eastern are the following:

<i>Ophioglossum Engelmanni</i>	<i>Phytolacca americana</i>
<i>Cheilanthes tomentosa</i>	<i>Acalypha ostryaefolia</i>
<i>Eragrostis pectinacea</i>	<i>Euphorbia dentata</i>
<i>Panicum dichotomiflorum</i>	<i>E. heterophylla</i>
<i>Phalaris caroliniana</i>	<i>Helianthemum majus</i>
<i>Hexalectris spicata</i>	<i>Ambrosia aptera</i>
<i>Ostrya virginiana</i>	<i>A. psilostachya</i>
<i>Rumex altissimus</i>	<i>Heterotheca subaxillaris</i>
<i>Chenopodium Berlandieri</i>	<i>Lactuca graminifolia</i>

It is interesting to note here, in connection with the presence of eastern plants in northwestern Mexico, that Sharp (39) and Schornherst (37) have found that certain mosses of the southwestern states and northern Mexico occur in the southern Appalachians and northern Florida. If these subtropical mosses migrated into the southeastern United States, as Schornherst believes, then northern plants must have had at the same time an opportunity to migrate southward into whatever areas provided a suitable habitat. We find a clear indication of such migration in *Ostrya virginiana*, which now has a not too discontinuous distribution from southeastern Canada to Nuevo León (28). South



FIG. 23 (upper left). Pine trees in the upper oak-grassland at La Nacha; elev. 1525 m. Among plants collected here are *Arbutus arizonica* and its parasite *Phoradendron Bolleanum*, *Arctostaphylos pungens*, *Quercus* spp., *Pinus cembroides*, *P. chihuahuana*, *P. ponderosa*, *Lonicera cerviculata* and others characteristic of the oak-grassland.

FIG. 24 (upper right). A thicket of oak, *Arctostaphylos* and *Cercocarpus eximius* with scattered pines and junipers. Slope of Picacho del Pilar; elev. 2080 m.

FIG. 25 (lower left). An open park-like stand of pine with an understory of oak. El Roble, 1830 m.

FIG. 26 (lower right). Cañón de Carabinas near El Roble. A deep inaccessible canyon with a small stand of *Pseudotsuga mucronata*.

of this point it is replaced by the very similar *O. guatemalensis* (Winkl.) Rose which continues southward into Guatemala and is also present in the western Sierra Madre at least as far north as Jalisco. Going still farther north we again find *O. virginiana* in Sinaloa (15) and Sonora. In a previous paper (59) I suggested the possibility that *Ostrya* in northwestern Mexico is a relic of Miocene and Pliocene times when the fossil type known as *O. oregoniana* Chaney (considered to be identical with *O. virginiana*) occupied portions of our northwestern states (46). Two possible routes by which *O. virginiana* could have migrated to northwestern Mexico were pointed out, namely southward from northwestern United States or westward from the eastern states. It is worthwhile pointing out that this disjunct distribution of *Ostrya virginiana* very closely parallels that of *Platanus* as outlined by Cain (9). He concludes from the present distribution of the sycamores and other trees (e.g. *Juglans* and *Fraxinus*) that a non-desert type of vegetation was once continuous across southwestern United States, and that this continuity was broken by the onset of desert conditions in the late Cenozoic. In the case of *Platanus* we have in the east *P. occidentalis*, in the southwest *P. Wrightii* and in California *P. racemosa*. *Ostrya* is not represented in California, but in west Texas and New Mexico there is *O. Baileyi* and in Arizona and Utah, *O. Knowltoni*; besides these two species the eastern form, *O. virginiana*, still persists in at least two small areas in northwestern Mexico. This circumstance lends additional support to the hypothesis that a continuous mesophytic vegetation extended across the southwestern states (and northern Mexico) prior to the establishment of desert conditions.

The possibility of a continuous distribution of *Ostrya virginiana*, during past geologic times, from northwestern Mexico to northwestern United States is not ruled out, however, although paleontological evidence for such a connection has not yet been found. The present and fossil occurrence of the sections *Saccharina* and *Palmata* of the genus *Acer*, as presented by Cain (9), strongly suggests that there may have been a connecting link between these two remote areas of western North America.

In the light of the preceding discussion it is not difficult to understand the presence of other eastern species in southwestern United States and northwestern Mexico.

7. *Plants with Continental Distribution*.—We are here first concerned with a group of plants which are widely distributed throughout North America, especially in the northern portion, and which are commonly represented by the same or a closely related form on other continents. Fernald (13) has pointed out that these species are to be regarded as members of an ancient, widespread boreal vegetation. Stopes (49) believes that this vegetation was in existence at least by the Cretaceous period, and that it was rather uniform in composition throughout its geographical range. The present distribution of the surviving members of that vegetation must therefore be interpreted in the light of past geological history, especially the incursion and recession of epicontinental seas, mountain building, glaciation, and the changes in climate which accompany these phenomena.

The following species, collected in northeastern Sonora, appear to be remnants of this early northern flora:

Ophioglossum vulgatum
Asplenium Trichomanes
Koeleria cristata
Sporobolus cryptandrus
Juncus Torreyi
Smilacina racemosa
Cerastium nutans
Silene antirrhina

Agrimonia striata
Rhus strigosus
Rhus glabra
R. Rydbergii
Parthenocissus quinquefolia
Vitis cinerea
Chimaphila maculata
Pterospora Andromedae
Limosella aquatica

A smaller group of plants with a wide distribution in North America appears to have its affinities in the tropics, although some of the species range as far north as southern Canada. These are:

Adiantum Capillus-Veneris
Pellaea atropurpurea
Bouteloua hirsuta

Sphenopholis obtusata
Crotalaria sagittalis
Physalis pubescens
Diodia teres var. *angustata*

8. *Tropical Plants*.—Besides a number of pan-tropical weeds, this group includes many species confined to the western hemisphere. The northern limit of these tropical plants is roughly from Florida to southern California, but with regard to their southern limits two distribution patterns may be distinguished. We find the plants of the principal distribution area ranging almost throughout the mainland of Mexico (exclusive of the Yucatán Peninsula), and southward for varying distances into Central America, many species reaching northern, or even southern, South America. A smaller group of species, besides occupying the above area, is also found in Yucatán and the West Indies.

In the first group the following may be mentioned:

Asplenium Palmeri
Cheilanthes pyramidalis
Notholaena aurea
Aristida divaricata
Bouteloua aristidoides
B. filiformis
Coltea pappophoroides
Eragrostis intermedia
E. mexicana
Muhlenbergia microsperma
Panicum hirticaule
Pappophorum Wrightii
Setaria Liebmanni
*Sporobolus microspermus*⁸
Tripsacum lanceolatum
Cyperus flavus
C. Manimae var. *asperrimus*
Eleocharis nodulosa
Stenophyllus capillaris
Salix taxifolia

Cassia leptocarpa
Crotalaria pumila
Dalea leporina
Parkinsonia aculeata
Phaseolus heterophyllus
Vicia pulchella
Zornia diphylla
Cuphea Wrightii
Oenothera laciniata
Haplophyton cimicidum
Loeselia glandulosa
Valeriana sorbifolia
Lobelia laxiflora
Aster spinosus
Baccharis glutinosa
Eupatorium pycnocephalum
Flaveria trinervia
Pinaropappus roseus
Selloa glutinosa
Zexmenia podoccephala

The species also found in Yucatán and the West Indies are:

Notholaena sinuata
Pellaea ternifolia
Polypodium thysanolepis
Aristida ternipes

Commicarpus scandens
Sida procumbens
Evolvulus sericeus
Trixis radialis
Zinnia multiflora

⁸Ranges northward to Montana and Washington.

It should be noted that most of the plants in the first of the above lists have their distribution principally in western North America, a fact which may be interpreted as a result of the inundation of eastern Mexico and much of central United States by Cretaceous seas (38). During the lower Cretaceous all but a narrow western border of Mexico was under water, but at the same time there was a direct connection between this elevated area and the West Indies through Nicaragua and the southern border of Honduras and Guatemala. This connection provides us with an answer to Standley's question: "Por qué (con la excepción de la península yucateca) el mayor número de elementos de la flora antillana que existen en México, se encuentran en la costa del Pacífico y no en la del Caribe?" (48).

9. *Plants with anomalous distribution.*—Anomalous distributions are here considered to be those which are discontinuous over two or more continents. The outstanding examples among the plants collected in Bavispe River area are *Ceterach Dalhousiae* and *Asplenium exiguum*, which are known only from southwestern United States, northwestern Mexico, Africa and northern India (21, 51).

The following are plants which have a disjunctive distribution in North and South America:

Bouteloua chondrosioides
B. simplex
Leptochloa dubia
Scleropogon brevifolius
Prosopis chilensis

Larrea divaricata
Dodonaea viscosa
Koeberlinia spinosa
Gaura parviflora var. *lachnocarpa*
Evolvulus arizonicus

Johnston (20) has discussed the significance of the woody plants common to North and South America deserts, and considers that they are primarily of southern origin, while the herbaceous species are of northern derivation.

SUMMARY

1. The present paper is based on collections made during the years 1938-1941; approximately 4000 numbers were obtained representing some 1200 named species and varieties of pteridophytes and phanerogams. Most of the collecting was done in the Sierra del Tigre, within the loop of the Río de Bavispe, an area of about 2400 square kilometers.

2. The climate varies from arid at low elevations to warm temperate rainy at high altitudes (1800 m. or more). The climatic symbols applicable are BShw for elevations of 1800 m. or less and Cw for areas of more than 1800 m. The average annual precipitation is estimated to range from 250 mm. to 650 mm. or more according to altitude.

3. Three broad types of vegetation are recognized: 1, the mesquite-grassland at an elevation of 1000 m. or less; 2, oak-grassland from 1000 m. to 1800 m. and 3, pine forest above 1800 m. These are discussed and lists of characteristic plants are given.

4. Approximately 10% of the species recorded here do not occur in Arizona. Most of these are Mexican plants which here reach their northern limit, but others, such as *Ostrya virginiana* and *Helianthemum majus* appear to be relics of an ancient boreal flora.

5. The flora of the region of the Río de Bavispe as a whole is similar to that of other parts of northwestern Mexico and southwestern United States, and similarly contains certain species which indicate a relationship with other parts of North America, with the West Indies, South America and even other continents.

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CATALOG OF COMMON NAMES

An attempt was made to record the local names of all plants collected. In general it may be stated that all the conspicuous plants, such as trees, shrubs, cacti, agaves, yuccas and certain grasses, as well as medicinal and other plants of economic value, have standardized names. A species may have more than one common name, but a given common name is seldom applied to more than one kind of plant, unless it be to a group of closely related species.

Agoriza.....	<i>Juniperus</i> sp.	Cardo santo....	<i>Cirsium arizonicum</i>
Alamillo.....	<i>Alnus oblongifolia</i>	Cebolla.....	<i>Allium</i> spp.
Alamo.....	<i>Populus</i> spp.	Chamiso.....	<i>Encelia farinosa</i>
Alamo loco.....	<i>Nicotiana glauca</i>	Chichicayota....	<i>Cucurbita digitata</i>
Algodoncillo....	<i>Gossypium Thurberi</i>	Chichiquelite....	<i>Solanum nigrum</i>
Aliso.....	<i>Platanus Wrightii</i>	Chichiquelite....	<i>Solanum</i> sp.
Amapola.....	<i>Papaver somniferum</i>	Chicoria.....	<i>Bouvardia glaberrima</i>
Amol.....	<i>Agave Schottii</i>	Chilicote.....	<i>Erythrina flabelliformis</i>
Amole.....	<i>Agave Hartmanni</i>	Chicuri.....	<i>Franseria ambrosioides</i>
Amolillo.....	<i>Agave Schottii</i>	Chilillo.....	<i>Polygonum</i> spp.
Amor.....	<i>Mentzelia hispida</i>	Chinita.....	<i>Sonchus asper</i>
Antipusi.....	<i>Rhynchosia pyramidalis</i>	Chino.....	<i>Pithecollobium</i>
Azucena del			<i>mexicanum</i>
campo.....	<i>Milla biflora</i>	Chírahui.....	<i>Acacia pennatula</i>
Baburia.....	<i>Ipomoea ancisa</i>	Chirrión.....	<i>Sapindus Saponaria</i>
Bachata.....	<i>Condalia lycioides</i>	Chual.....	<i>Chenopodium</i> spp.
Bagote.....	<i>Parkinsonia aculeata</i>	Chuchuni.....	<i>Ambrosia aptera</i>
Baiburín.....	<i>Kallstroemia grandiflora</i>	Ciénaga.....	<i>Eleocharis</i> spp.
Baisómari.....	<i>Mimulus</i> spp.	Cocolmea.....	<i>Phaseolus Metcalfei</i>
Barba de chivo. <i>Clematis Drummondii</i>		Cola de zorra....	<i>Muhlenbergia dumosa</i>
Barba de viejo. <i>Clematis Drummondii</i>		Colita de ratón. <i>Polypogon mon-</i>	
Batamote.....	<i>Baccharis glutinosa</i>		<i>speliensis</i>
Bavisa.....	<i>Cosmos crithmifolius</i>	Cordoncillo....	<i>Elytraria</i> spp.
Bebelama.....	<i>Bumelia occidentalis</i>	Cuetito.....	<i>Ruellia nudiflora</i> var.
Bellota.....	<i>Quercus Emoryi</i> & <i>Q.</i>		<i>glabrata</i>
	<i>viminea</i>	Cúmaro.....	<i>Celtis reticulata</i>
Berro.....	<i>Radicula Nasturtium-</i>	Dátil.....	<i>Yucca</i> sp.
	<i>aquaticum</i>	Encino.....	<i>Quercus</i> spp.
Binorama.....	<i>Acacia constricta</i>	Encino azul....	<i>Quercus arizonica, Q.</i>
Bledo.....	<i>Amaranthus</i> spp.		<i>oblongifolia</i>
Brea.....	<i>Cercidium praecox</i>	Encino blanco....	<i>Quercus arizonica</i>
Caballito.....	<i>Tecoma incisa</i>	Encino chaparro	<i>Quercus Toumeyi</i>
Cabecita de		Encino chino....	<i>Quercus chihuahuensis</i>
viejo.....	<i>Mammillaria</i> spp.	Encino colorado.	<i>Quercus hypoleucoides</i>
Calabacilla....	<i>Cucurbita digitata</i>	Encino hueja....	<i>Quercus Endlichiana</i>
Canahuala.....	<i>Notholaena sinuata</i>	Encino hueja....	<i>Quercus fulva</i>
Canutillo.....	<i>Ephedra trifurca</i>	Escobita de la	
Cañaira.....	<i>Begonia martiana</i>	Virgen.....	<i>Eriogonum Ainsliei</i>
Cañaire.....	<i>Rumex</i> spp.	Preza silvestre.	<i>Rubus</i> sp.
Capulín.....	<i>Prunus virens</i>	Fresno.....	<i>Fraxinus</i> spp.
Cardo.....	<i>Argemone alba</i>	Fresno.....	<i>Ptelea trifoliata</i>

- Frijol.....*Phaseolus vulgaris*
 Gallinita.....*Mascagnia* spp.
 Garambullo.....*Celtis pallida*
 Gatitio.....*Martynia* spp.
 Gatuño.....*Martynia fragrans*
 Gatuño.....*Mimosa Wrightii*
 Girasol.....*Helianthus annuus*
 Golondrina.....*Euphorbia* spp.
 Guasaraco.....*Parthenium Siramonium*
 Hiedra.....*Rhus Rydbergii*
 Hierba del aire..*Baccharis thesioides*
 Hierba del aire..*Trixis radialis*
 Hierba colorada..*Potentilla atrorubens*
 Hierba colorada..*Rumex mexicana*
 Hierba del
 empeine.....Undet. sp. of *Cassia*.
 Plant lost.
 Hierba de la
 flecha.....*Sapium biloculare*
 Hierba del indio..*Aristolochia Watsoni*
 Hierba del indio..*Sarcostemma crispum*
 Hierba loca.....*Crotalaria lupulina*
 Hierba del
 manso.....*Anemopsis californica*
 Hierba del oso..*Prionosciadium Watsoni*
 Hierba pegajosa..*Mentzelia multiflora*
 Hierba del piojo..*Cassia leptocarpa*
 Hierba del piojo..*Haplophyton*
 cimicicidum
 Hierba del piojo..*Mandevilla foliosa*
 Hierba salada..*Gaura parviflora* var.
 lachnocarpa
 Hierba de la
 tórtola.....*Croton texensis*
 Hierba del
 venado.....*Porophyllum macro-*
 phyllum
 Hierba de la
 vibora.....*Berlandiera lyrata*
 Higuera.....*Ficus Carica*
 Higuerrilla.....*Ricinus communis*
 Hipasote.....*Chenopodium*
 ambrosioides
 Hinojo.....*Foeniculum vulgare*
 Hoja semita.....*Senecio Hartwegi*
 Hojasén.....*Cassia Covesii*
 Hojasén.....*Cassia* sp.
 Huajuco.....*Bumelia rigida*
 Huata.....*Juniperus* sp.
 Huate.....*Juniperus* sp.
 Huérigo.....*Populus acuminata*
 Huérigo.....*P. monticola*
 Huinol.....*Acacia cymbispina*
 Jaboncillo.....*Tillandsia recurvata*
 Jarilla.....*Baccharis glutinosa*
 Jarilla.....*Salix jaliscana*
 Jécota.....*Hymenoclea monogyra*
 Jécota.....*Selloa glutinosa*
 Juanlipili.....*Boerhaavia* spp.
 Júcaro.....*Alnus oblongifolia*
 Júcaro.....*Ostrya virginiana*
 Jumete.....*Euphorbia* spp.
 Junco.....*Ceanothus Huichagorare*
 Lágrima de
 María.....*Commelina* sp.
 Lama del agua..*Potamogeton diversi-*
 folius
 Lechuguilla....*Agave* spp.
 Lila.....*Melia Azedarach*
 Lima.....*Rhus* spp.
 Lima de la
 sierra.....*Rhus microphylla*
 Limita (de la
 sierra).....*R. microphylla*
 Limoncillo.....*Dalea Lumholtzii*
 Limpiatuna.....*Abutilon* spp.
 Limpiatuna.....*Kosteletzkya Thurberi*
 Madroño.....*Arbutus arizonica*
 Mala mujer.....*Tragia laciniata*
 Mamelique.....*Krameria Grayi*
 Manzanilla de
 coyote.....*Perityle microglossa*
 Manzanita.....*Arctostaphylos pungens*
 Maravilla.....*Mirabilis Wrightiana*
 Marrubia.....*Marrubium vulgare*
 Matarique.....*Cacalia decomposita*
 Mauto.....*Lysiloma microphylla*
 Melón de
 coyote.....*Apodanthera undulata*
 Mescal
 lechuguilla....*Agave* sp.
 Mesquite.....*Prosopis chilensis*
 Mirto.....*Bouvardia glaberrima*
 Mora.....*Morus alba*
 Mostaza.....*Brassica nigra*
 Nogal.....*Juglans major*
 Nopal.....*Opuntia* spp.
 Nopal
 duraznillo....*Opuntia* sp.
 Ocotillo.....*Fouquieria* spp.
 Ocotillo (del
 corral).....*F. splendens*
 Orégano.....*Monarda austromontana*
 Oreja de mula..*Asclepias glaucescens*
 Ortiga.....*Polanisia uniglandulosa*
 Ortiguilla.....*Cnidoscolus angustidens*
 Ortiguilla.....*Tragia nepetaefolia*
 Ortija.....*Cnidoscolus angustidens*
 Palma.....*Washingtonia Sonorae*
 Palmilla.....*Nolina microcarpa*
 Palo amarillo..*Mahonia haematocarpa*
 Palo del asta...*Cordia Sonorae*⁹
 Palo azucar.....*Acer brachypterum*
 Palo blanco.....*Ipomoea arborescens*
 Palo dulce.....*Eysenhardtia* spp.
 Palo loco.....*Nicotiana glauca*
 Palo mulato...*Bursera laxiflora*
 Palo santo.....*Aralia humilis*
 Pamita
 cimarrón....*Lepidium Eastwoodiae*
 Papache.....*Randia Watsoni*
 Parra.....*Vitis arizonica*
 Pata de cuervo..Undetermined
 malvaceous plant

⁹Observed but not collected east of Guasabas.

Pera.....	<i>Pyrus communis</i>	Táscali.....	<i>Juniperus</i> spp.
Pinabete.....	<i>Pseudotsuga mucronata</i>	Té Limón.....	<i>Dalea Lumbholtzii</i>
Pino.....	<i>Pinus</i> spp.	Témaqui.....	<i>Amoreuxia palmatifida</i>
Pino blanco.....	<i>P. ponderosa</i>	Tepeguaje.....	<i>Lysiloma Watsoni</i>
Pino chimonque.....	<i>P. chihuahuana</i> & <i>P. ayacahuile</i> var. <i>brachyptera</i>	Tepe: uaje.....	<i>Lysiloma Watsoni</i>
Piñón.....	<i>P. cembroides</i>	Tésota.....	<i>Acacia Greggii</i>
Piocha.....	<i>Melia Azedarach</i>	Tezcalama.....	<i>Ficus petiolaris</i>
Pionía.....	<i>Zexmenia podocephala</i>	Tihuinahua.....	<i>Hieracium Fendleri</i>
Pitaya.....	<i>Lemaireocereus Thurberi</i>	Tininahua.....	<i>Hieracium Fendleri</i>
Pochote.....	<i>Ceiba acuminata</i>	Toji.....	<i>Phoradendron</i> spp.
Poño.....	<i>Cowania Stansburiana</i>	Toloache.....	<i>Datura</i> spp.
Quelite.....	<i>Amaranthus</i> spp.	Tomate.....	<i>Lycopersicum exculentum</i>
Quesito.....	<i>Anoda cristata</i>	Tomatillo.....	<i>Physalis ixocarpa</i>
Rama de amores.....	<i>Physalis hederifolia</i>	Tomatillo cimarrón.....	<i>Physalis Wrightii</i>
Romerillo.....	<i>Baccharis sarothroides</i>	Tomatito.....	<i>Physalis</i> spp.
Saetilla.....	<i>Bidens pilosa</i>	Tomatito.....	<i>Solanum elaeagnifolium</i>
Salicieso.....	<i>Lycium Andersonii</i>	Tomatito de buena mujer.....	<i>Solanum elaeagnifolium</i>
Salicieso.....	<i>Rhamnus betulaeifolia</i>	Torota.....	<i>Bursera confusa</i>
Salsamora.....	<i>Morus microphylla</i>	Torota blanca.....	<i>Jatropha cordata</i>
Sámota.....	<i>Esenbeckia Hartmannii</i>	Torota prieta.....	<i>Bursera laxiflora</i>
Sandía.....	<i>Citrullus vulgaris</i>	Torota prieta.....	<i>Jatropha cordata</i>
Sangregado.....	<i>Jatropha cardiophylla</i>	Tortolita.....	<i>Croton texensis</i>
San Miguelito.....	<i>Antigonon leptopus</i>	Tostón.....	<i>Cosmos parviflorus</i>
San Miguelito.....	<i>Kallstroemia grandiflora</i>	Trébol.....	<i>Melilotus indica</i>
Saramatraca.....	<i>Cereus Greggii</i>	Trompillo.....	<i>Ipomoea desertorum</i>
Sauce.....	<i>Salix</i> spp.	Trompillo.....	<i>Quamoclit coccinea</i> var. <i>hederifolia</i>
Sauco.....	<i>Sambucus</i> spp.	Tronador.....	<i>Crotalaria lupulina</i>
Sauz.....	<i>Salix</i> spp.	Tulito.....	<i>Juncus Torreyi</i>
Saya.....	<i>Amoreuxia palmatifida</i>	Tulusisi.....	<i>Saracha procumbens</i>
Siemprevive.....	<i>Selaginella pilifera</i> var. <i>Pringlei</i>	Tutuqui.....	<i>Phaulothamnus spinescens</i>
Socoyoli.....	<i>Oxalis albicans</i>	Uña de león.....	Undetermined leguminous shrub
Sotol.....	<i>Dasyliirion Wheeleri</i>	Uva cimarrona.....	<i>Vitis cinerea</i>
Tabachín.....	<i>Caesalpinia</i> spp.	Uva trepadora.....	<i>Cocculus diversifolius</i>
Tabaco de coyote.....	<i>Nicotinia trigonophylla</i>	Uva tullidora.....	<i>Cocculus diversifolius</i>
Tamichi.....	<i>Krameria parvifolia</i>	Uvita tullidora.....	<i>Cocculus diversifolius</i>
Tapiro.....	<i>Buddleia Wrightii</i>	Verdolaga.....	<i>Portulaca oleracea</i>
Tarachico.....	<i>Dodonaea viscosa</i>	Zacate tule.....	<i>Tripsacum lanceolatum</i>
Tarachique.....	<i>Dodonaea viscosa</i>	Zacatón.....	<i>Tripsacum lanceolatum</i>
Taraiz.....	<i>Salix taxifolia</i>	Zapote.....	<i>Stemmadenia tomentosa</i> var. <i>Palmeri</i>
Táscate.....	<i>Juniperus</i> spp.		

ANNOTATED LIST OF SPECIES

The following list includes all the higher plants collected in north-eastern Sonora and at Carretas, Chihuahua, except a few which are not yet determined. The letters H, P, and S after collection numbers serve to identify collections by Harvey, Phillips and Santos respectively; other numbers represent my own collections.

A complete set of plants of all collectors is preserved in the University of Michigan Herbarium. Harvey and Santos have already distributed their grasses, but as I have no record of where they were sent, only the distribution of my plants is indicated in the list. The herbaria which have some of my plants (in most cases a rather complete set) are shown below with their identifying symbol:

- C—Prof. C. Conzatti, Oaxaca, Oaxaca, Mexico.
 G—Gray Herbarium, Harvard University.
 M—Instituto de Biología, Mexico, D. F.
 S—Dr. Forrest Shreve, Tuscon, Arizona.
 US—United States National Herbarium, Washington, D. C.

Most of Phillips' plants and some of my own have not yet been distributed.

Besides the plants collected sterile plants of *Viola* were seen on Picacho del Pilar, and of *Lupinus* at Puerto de los Aserraderos. Chuchupate (*Ligusticum Porteri* Coult. & Rose, according to Kearney and Peebles, 21) was never seen, yet it must exist in the area, for it is well known to the natives.

Thanks to the thorough collecting of Harvey and Santos the list of *Gramineae* presented here may well be one of the most complete local grass floras ever published for any part of Mexico. Even so, some omissions are probable, for a number of grasses not collected (e.g., *Poa* and *Trichloris*) are known from southeastern Arizona and northern Mexico (21).

Ophioglossaceae

- Ophioglossum Engelmanni* Prantl—4095.
Ophioglossum vulgatum L.—791-P; 4335.

Polypodiaceae

- Adiantum Capillus-Veneris* L.—538-P; 551-P; 592-P; 784-P; 382 C, G, S; 3297 C, G; M, S; 3304 G, M, S.
Asplenium exiguum Bedd.—550-P.
Asplenium Palmeri Maxon—1743-H; 281-P; 390-P; 391-P; 516-P.
Asplenium Trichomanes L.—548-P; 549-P; 584-P.
Bommeria hispida (Mett.) Underw.—1694-H; 381-P; 778-P, 543; 997 S; 4049; 4334 C, G, M, S.
Ceterach Dalhousiae (Hook.) C. Chr.—547-P.
Cheilanthes castanea Maxon—1695-H ?.
Cheilanthes Eatoni Baker—525-P.
Cheilanthes Fendleri Hook.—4204.
Cheilanthes leucopoda Link—529.
Cheilanthes Lindheimeri Hook.—303-P; 342-P; 759-P; 512 S; 961 S; 3229 C, G, M, S, 3888 M, S; 4045 M, S; 4452 M.
Cheilanthes Pringlei Davenp.—360-P; 361-P; 363-P; 392-P; 524-P; 526-P; 536-P.
Cheilanthes pyramidalis Fée—642-P; 674-P; 4323.
Cheilanthes tomentosa Link—270-P; 282-P.
Cheilanthes Wootoni Maxon—1696-H; 4050 M, S.
Cheilanthes Wrightii Hook.—1735-H; 326-P; 373-P; 380-P; 513-P; 537-P; 779-P; 4047 M, S.
Cystopteris fragilis (L.) Bernh.—720-P.
Dryopteris Féei C. Chr.—747-P; 381 G, S.
Dryopteris pilosa (Mart. & Gal.) C. Chr.—719-P.
Notholaena aurea (Poir.) Desv.—272-P; 273-P; 292-P; 378-P; 379-P; 389-P; 4213 G.
 All of the above except 379-P were distributed as *N. bonariensis* C. Chr.
Notholaena ferruginea Hook.—4653 M; 4744 M.
Notholaena Grayi Davenp.—293-P; 316-P; 4044a G, M, S; 4046 M.
Notholaena incana Presl—512-P; 750-P US.
Notholaena limitanea Maxon—738-P US.
Notholaena sinuata (Lag.) Kaulf.—Canahuala. 337-P; 532 G, S; 3890; 4044 G, M, S; 4856.
Notholaena sinuata var. *integerrima* Hook.—4585 M; 4869.
Notholaena Standleyi Maxon—4730 M, S.
Pellaea atropurpurea (L.) Link—4091.

- Pellaea intermedia* Mett.—3303 C, G, M, S; 4743 G.
Pellaea mucronata D. C. Eaton—511-P.
Pellaea ternifolia (Cav.) Link—4221.
Pellaea Wrightianna Hook.—274-P; 338-P; 419-P; 4222.
Phanerophlebia auriculata Underw.—546-P; 725-P.
Pityrogramma triangularis (Kaulf.) Maxon—527-P.
Polypodium erythrolepis Weatherby—496-P US.
Polypodium polypodioides (L.) Watt.—515-P.
Polypodium thysanolepis A. Br.—1706-H; 307-P.
Pteridium aquilinum (L.) Kuhn—418-P; 721-P; 4800.
Woodsia mexicana Fée—1721-H; 288-P; 447-P; 675-P; 4084.

Marsileaceae

- Marsilea vestita* Hook. & Arn.—805-P.

Equisetaceae

- Equisetum laevigatum* A. Br.—3977.

Selaginellaceae

- Selaginella novoleonensis* Hieron.—388-P US.
Selaginella pilifera A. Br. var. *Pringlei* (Baker) Morton—Siemprevive. 522 G, S; 2809.
Selaginella rupicola Underw.—1722-H; 284-P; 298-P; 343-P; 355-P; 533-P; 744-P; 775-P; 510 S; 2807 C; 3982 M, S.
Selaginella Wrightii Hieron. ?—800-P.

Pinaceae

- Abies concolor* (Gordon & Glendinning) Hoopes—506-P.
Cupressus arizonica Greene—581-P; 4175.
Juniperus Deppeana Steud. var. *pachyphloea* (Torr.) Martínez—2592; 2815; 3122; 3180; 3932; 4173.
Juniperus durangensis Martínez—4788 M.
Juniperus flaccida Schlecht.—3112; 3184?; 4093 M.
Juniperus monosperma (Engelm.) Sarg.—846-P; 2991; 3654?
Pinus arizonica Engelm.—Pino, pino blanco. 528 G, S; 3360? G, M, S.
Pinus ayacahuite Ehr. var. *brachyptera* Shaw—Pino chimonque. 3423 G, M, S; 3467 G, M, S.
Pinus cembroides Zucc.—Piñon. 959 G, M, S; 2828 C, G, M, S; 3509, G, M; 3941 M; 4321 M; 4738 M.
Pinus chihuahuana Engelm.—Pino. 565 G, S; 2732 G, M, S; 2827 C, G, M, S; 3174 C, G, M, S; 3409 C, G, M, S; 3942 M; 4202 M; 4789 M.
Pinus ponderosa Doug.¹⁰—Pino blanco. 2748 G, M, S; 2829 G, M, S; 3175 G, M; 3176 G, M, S; 3943 M; 4266 M.
Pseudotsuga mucronata (Raf.) Sudw.—Pinabete. 586-P; 3134 G, M, S; 3424 G, M, S.

Gnetaceae

- Ephedra trifurca* Torr.—Canutillo. 2854; 3826 M; 3878 M; 4525 G, M, S.

Naiadaceae

- Potamogeton diversifolius* Raf.—Lama del agua. 806-P.

Gramineae

- Aegopogon tenellus* (Cav.) Trin.—1714-H; 1927-S; 2143-S; 2153-S.
Agropyron arizonicum Scribn. & Smith—1920-S; 1962-S; 2163-S; 3157 G, S.
Agrostis verticillata Vill.—711 G, S; 716; 765 S.

¹⁰Apparently overlooking the fact that in the original description *P. arizonica* is characterized as having 5 leaves per fascicle (rarely only 3), Martínez considers that *P. ponderosa* in Mexico is confined to Baja California and calls the 3-leaved pine of Sonora and Chihuahua *P. arizonica*, and the 5-leaved pine he has described as *P. arizonica* forma *quinquefoliata*. This was previously pointed out in Little's review of Martínez's monograph on the Mexican pines (23).

- Andropogon barbinodis* Lag.—1615-H; 1719-H; 868-P; 1800-S; 1829-S; 1871-S; 1908-S; 1954-S; 1980-S; 2014-S; 2066-S; 2068-S; 2111-S; 1114 G, S; 3540 G, M, S; 3767 G.
- Andropogon cirratus* Hack.—1625-H; 1677-H; 1731-H; 1859-S; 1914-S; 1932-S; 2083-S; 2113-S; 2159-S.
- Andropogon hirtiflorus* (Nees) Kunth—1821-S; 1951-S; 2158-S.
- Aristida Adscensionis* L.—1593-H; 1635-H; 1675-H; 1784-S; 1858-S; 2020-S; 2030-S; 2081-S; 3035; 3544 G, S; 3768 G, M.
- Aristida arizonica* Vasey—3546 G, M, S.
- Aristida barbata* Fourn.—1602-H; 1947-S.
- Aristida divaricata* Humb. & Bonpl.—1631-H; 1910-S; 2156-S.
- Aristida glauca* (Nees) Walp.—1760-S; 2031-S.
- Aristida Orcuttiana* Vasey—1986-S; 2021-S.
- Aristida pansa* Woot. & Standley—1766-S; 2069-S.
- Aristida Schiedeana* Trin. & Rupr.—1638-H; 1709-H; 1826-S; 1938-S; 2157-S.
- Aristida ternipes* Cav.—1594-H; 1633-H; 1728-H; 1789-S; 1797-S; 1806-S; 1853-S; 2006-S; 2036-S; 2070-S; 3060 G, M, S; 3567 G, M, S; 3764 G, M, S; 3766 ? G, M, S.
- Arundo Donax* L.—1892-S.
- Avena fatua* L.—2026-S.
- Blepharoneuron tricholepis* (Torr.) Nash—1923-S; 1967-S; 2147-S.
- Bouteloua aristidoides* (H. B. K.) Griseb.—1599-H; 1657-H; 1780-S; 1830-S; 1993-S; 2047-S; 3575 G, M, S; 657 G, S; 3805 G, M.
- Bouteloua barbata* Lag.—1593-H; 2051-S.
- Bouteloua chondrosioides* (H. B. K.) Benth.—1725-H; 1783-S; 3655 G, S.
- Bouteloua curtipendula* (Michx.) Torr.—1611-H; 1613-H; 1648-H; 850-P; 865-P; 1753-S; 1773-S; 1799-S; 1814-S; 1946-S; 1964-S; 2004-S; 2071-S; 2121-S; 766 S; 3062; 3541 G, M, S; 3662 G, M, S; 3763 G, M, S.
- Bouteloua eriopoda* (Torr.) Torr.—1981-S; 2029-S; 2122-S.
- Bouteloua filiformis* (Fourn.) Griffiths—863-P; 1763-S; 1854-S; 2007-S; 2019-S; 2034-S; 2072-S; 2103-S; 3050 G; 3339 G; 3563 G, M, S; 3755 G, S.
- Bouteloua glandulosa* (Cerv.) Swallen—1710-H.
- Bouteloua gracilis* (H. B. K.) Lag.—1597-H.
- Bouteloua hirsuta* Lag.—1632-H; 1679-H; 1711-H; 864-P; 1801-S; 1812-S; 1864-S; 1934-S; 1949-S; 2005-S; 2087-S; 2120-S; 2137-S; 3143; 3661 ? G, S.
- Bouteloua Parryi* (Fourn.) Griffiths—3570 G.
- Bouteloua radicata* (Fourn.) Griffiths—1612-H; 1678-H; 1803-S; 1933-S; 1960-S; 2102-S; 3660 G, M, S.
- Bouteloua rigidiseta* (Steud.) Hitchc.—1762-S; 1813-S.
- Bouteloua Rothrockii* Vasey—1642-H; 1712-H; 813-P; 1779-S; 1848-S; 2003-S; 1886-S; 757.
- Bouteloua simplex* Lag.—1940-S.
- Bromus anomalus* Rupr.—2079-S; 2136-S; 2167-S.
- Bromus ciliatus* L.—2128-S.
- Bromus frondosus* (Shear) Woot. & Standley—1693-H; 1915-S; 1939-S.
- Bromus laciniatus* Beal—2129-S.
- Bromus marginatus* Nees—3482 G, M, S.
- Bromus polyanthus* Scribn.—638-P.
- Bromus* sp.—1840-S.
- Cathestecum erectum* Vasey & Hack.—1788-S; 1899-S; 2033-S; 2571 M, S.
- Cenchrus pauciflorus* Benth.—1605-H; 857-P; 1776-S; 2046-S; 649 S; 2904 G; 3783.
- Chloris submulica* H. B. K.—2168-S.
- Chloris virgata* Swartz—1629-H; 1678-H; 1831-S; 1845-S; 1872-S; 1944-S; 2023-S; 2117-S; 3670 G, S.
- Cotlea pappophoroides* Kunth.—2022-S; 2094-S; 2170-S.
- Cynodon Dactylon* (L.) Pers.—1655-H; 1786-S; 1810-S; 1868-S; 1883-S; 2001-S; 2118-S.
- Deschampsia Pringlei* Scribn.—2127-S.
- Digitaria argillacea* (Hitchc. & Chase) Fernald—1673-H; 1708-H.
- Digitaria sanguinalis* (L.) Scop.—1595-H; 1650-H; 819-P; 1827-S; 1844-S; 1869-S; 1878-S; 1902-S; 1941-S; 1998-S; 647 S; 3036 G, M, S; 3710 G, M, S; 3752 G, M, S.
- Echinochloa colonum* (L.) Link.—1656-H; 319-P; 828-P; 1807-S; 1841-S; 1866-S; 1877-S; 1997-S; 3048 G, M, S; 3754 G, M, S.
- Echinochloa Crus-galli* (L.) Beauv.—1867-S.
- Echinochloa Crus-galli* var. *mitis* (Pursh) Peterm.—1876-S.
- Echinochloa Crus-galli* var. *zelayensis* (H. B. K.) Hitchc.—1945-S.
- Elyonurus barbiculmis* Hack.—1865-H; 1819-S; 1860-S; 1931-S; 1950-S; 1979-S; 2082-S; 2112-S.

- Eragrostis cilianensis* (All.) Link.—1592-H; 1681-H; 1811-S; 1833-S; 1847-S; 1881-S; 1893-S; 1942-S; 1996-S; 1999-S; 2095-S; 673 G, S; 764 G, S; 2883 G; 3659 G, M, S; 3770 G, M, S.
- Eragrostis diffusa* Buckl.—1591-H; 1604-H; 1718-H; 822-P; 3753.
- Eragrostis erosa* Scrib.—1749-H; 1991-S.
- Eragrostis intermedia* Hitch.—1603-H; 1626-H; 1645-H; 589-P; 1771-S; 1791-S; 1805-S; 2040-S; 2080-S; 2123-S; 715; 3061 G; 3329 G, M, S; 3614 G, S; 3671 G, M, S; 3743 G, M, S.
- Eragrostis mexicana* (Hornem.) Link.—2113-S.
- Eragrostis neomexicana* Vasey.—1590-H; 1646-H; 1672-H.
- Eragrostis pectinacea* (Michx.) Nees.—1929-S; 1955-S; 2000-S; 2057-S; 747.
- Eragrostis* sp.—1911-S; 2119-S.
- Eriochloa aristata* Vasey.—1649-H; 2024-S.
- Eriochloa gracilis* (Pourn.) Hitchc.—1622-H; 1792-S; 1835-S; 1870-S; 1884-S; 1912-S; 1943-S.
- Eriochloa gracilis* var. *minor* (Vasey) Hitchc.—1846-S.
- Eriochloa Lemmoni* Vasey & Scribn.—1652-H; 3760.
- Eriochloa* sp.—1887-S.
- Festuca octoflora* Walt.—1774-S; 1828-S.
- Hackelochloa granularis* (L.) Kuntze.—1674-H; 1953-S.
- Heteropogon contortus* (L.) Beauv.—1618-H; 1683-H; 1767-S; 1795-S; 1809-S; 1852-S; 1983-S; 2035-S; 2073-S; 2114-S; 3798 G, M.
- Heteropogon melanocarpus* (Ell.) Benth.—1717-H.
- Hilaria Belangeri* (Steud.) Nash.—1770-S; 1782-S; 1802-S; 1815-S; 2032-S; 3651 G, M, S.
- Hilaria cenchroides* H. B. K.—1621-H; 1680-H.
- Hilaria mutica* (Buckl.) Benth.—1634-H; 1751-S; 1775-S; 2062-S.
- Koeleria cristata* (L.) Pers.—1977-S; 2126-S; 2161-S.
- Leptochloa dubia* (H. B. K.) Nees.—1620-H; 1764-S; 1804-S; 1825-S; 1906-S; 2010-S; 2043-S; 2089-S; 2116-S; 2171-S; 1115 G, S; 3547 G, M, S; 3606 G, M, S; 3750 G, M, S.
- Leptochloa filiformis* (Lam.) Beauv.—1607-H; 1713-H; 1734-H; 321-P; 1843-S; 1880-S; 1905-S; 1994-S; 3738.
- Lycurus phleoides* H. B. K.—1610-H; 1692-H; 1818-S; 1917-S; 1936-S; 1952-S; 1982-S; 2039-S; 2088-S; 2124-S; 2130-S; 3335 G, S; 3605 G, M, S.
- Muhlenbergia arizonica* Scribn.—1624-H; 1697a-H; 953 S.
- Muhlenbergia ciliata* (H. B. K.) Kunth.—1742-H.
- Muhlenbergia dumosa* Scribn.—Cola de zorra. 589 G, S; 2823 G, M, S.
- Muhlenbergia Emmersleyi* Vasey.—1627-H; 1641-H; 1688-H; 1798-S; 1820-S; 1925-S; 1974-S; 2090-S; 2109-S; 2110-S; 2166-S; 3631.
- Muhlenbergia longiligula* Hitch.—1963-S; 2164-S.
- Muhlenbergia microsperma* (DC.) Kunth.—2048-S; 2172-S.
- Muhlenbergia montana* (Nutt.) Hitchc.—1639-H; 1924-S; 2138-S.
- Muhlenbergia monticola* Buckl.—1659-H; 1729-H; 1793-S; 1817-S; 1824-S; 1909-S; 1919-S; 1975-S; 2041-S; 2078-S; 2084-S; 2125-S; 3762 G, S.
- Muhlenbergia polycaulis* Scribn.—1823-S; 1935-S; 2086-S; 2097-S; 2146-S ?
- Muhlenbergia pauciflora* Buckl.—1715-H; 1930-S; 1958-S; 1961-S; 1965-S; 1966-S; 2165-S.
- Muhlenbergia Porteri* Scribn.—1897-S; 1976-S; 2008-S; 2011-S; 2042-S; 2054-S; 2018-S.
- Muhlenbergia pusilla* Steud.—2140-S.
- Muhlenbergia repens* (Presl) Hitch.—2134-S.
- Muhlenbergia rigens* (Benth.) Hitch.—1988-S; 2096-S; 2131-S.
- Muhlenbergia rigida* (H. B. K.) Kunth.—2139-S.
- Muhlenbergia texana* Buckl.—1697-H; 1957-S; 2141-S.
- Muhlenbergia virescens* (H. B. K.) Kunth.—1926-S.
- Oplismenus Burmanni* (Retz.) Beauv.—1644-H.
- Panicum arizonicum* Scribn. & Merr.—1601-H; 1785-S; 1834-S; 1861-S; 1890-S; 1903-S; 2016-S; 2045-S; 2101-S; 3301; 3543 G, S.
- Panicum bulbosum* H. B. K.—1647-H; 637-P; 1822-S; 1839-S; 1937-S; 2160-S; 603; 604-S; 3144 G, M, S; 3413 G, M, S; 3500 G, M, S.
- Panicum bulbosum* var. *minus* Vasey.—1616-H; 1916-S.
- Panicum dichotomiflorum* Michx.—602.
- Panicum fasciculatum* Swartz.—1838-S; 1885-S.
- Panicum fasciculatum* var. *reticulatum* (Torr.) Beal.—2050-S.

- Panicum Ghiesbreghtii* Fourn.—1794-S; 1932-S.
Panicum hirticaule Presl—1600-H; 1653-H; 1836-S; 1842-S; 1850-S; 1907-S; 2009-S; 2015-S; 2052-S; 2100-S; 3568; 3658; 3758.
Panicum lepidulum Hitchc. & Chase—3542 G, M, S.
Panicum obtusum H. B. K.—1630-H; 1752-S; 1781-S; 1808-S; 1882-S; 2065-S.
Pappophorum Wrightii Wats.—1748-H; 2056-S; 2061-S; 2169-S.
Paspalum Botteri (Fourn.) Chase—1654-H.
Paspalum convexum Humb. & Bonpl.—1707-H.
Paspalum distichum L.—1875-S.
Paspalum stramineum Nash—1849-S ?
Phalaris caroliniana Walt.—2027-S.
Piptochaetium fimbriatum (H. B. K.) Hitchc.—1913-S; 1921-S; 2145-S; 2155-S.
Polypogon monspeliensis (L.) Desf.—Colita de ratón. 714 G, S.
Scleropogon brevifolius Phil.—1873-S.
Setaria Grisebachii Fourn.—1596-H; 1716-H; 1741-H; 1889-S; 1904-S; 1948-S; 1992-S; 2055-S.
Setaria Liebmanni Fourn.—1111 G, S; 3545 G.
Setaria macrostachya H. B. K.—322-P; 1754-S; 1755-S; 1759-S; 1772-S; 1777-S; 1863-S; 1888-S; 1987-S; 2018-S; 2044-S; 2067-S; 2115-S; 648; 733; 2884; 3611 G, M, S.
Setaria villosissima (Scribn. & Merr.) Scribn.—2098-S.
Setaria viridis (L.) Beauv.—3732 G, M, S.
Sitanion Hystrix (Nutt.) G. Smith—1682-H; 2085-S; 2135-S.
Sorghum halapense (L.) Pers.—1651-H; 1837-S; 1879-S.
Sorghum vulgare Pers.—2059-S; 2060-S.
Sorghum vulgare var. *saccharatum* (L.) Boerl.—2049-S.
Sphenopholis obtusata (Michx.) Scrib.—320-P.
Sporobolus contractus Hitchc.—2063-S.
Sporobolus cryptandrus (Torr.) Gray—2025-S; 2058-S; 2063-S.
Sporobolus interruptus Vasey—686-P ?
Sporobolus microsperrmus (Lag.) Hitchc.—1623-H; 1658-H; 1816-S; 1926-S; 2017-S; 2093-S; 2132-S; 2144-S; 2656 B; 2759 G, S.
Sporobolus ramulosus (H. B. K.) Kunth—2142-S; 2162-S.
Sporobolus texanus Buckl.—1687-H.
Sporobolus Wrightii Munro—1606-H; 1750-S; 1778-S; 1891-S; 2064-S.
Stipa Pringlei Scribn.—1922-S; 1959-S; 2154-S.
Trachypogon Montufari (H. B. K.) Nees—1640-H; 1686-H; 1730-H; 1769-S; 1856-S; 1985-S; 2099-S.
Tragus Berteronianus Schult.—1614-H.
Trichachne californica (Benth.) Chase—1619-H; 1727-H; 1761-S; 1765-S; 1855-S; 1862-S; 1898-S; 1918-S; 1978-S; 1989-S; 2012-S; 2013-S; 2037-S; 2038-S; 2074-S; 2076-S; 2104-S; 2106-S.
Trichachne insularis (L.) Nees—1726-H; 1757-S; 1768-S; 1787-S; 1790-S; 1857-S; 1900-S; 2075-S; 2105-S; 3636 G, S; 3771 G.
Trichachne patens Swallen—3765 G.
Triodia mutica (Torr.) Scribn.—1756-S; 1895-S; 1984-S; 2028-S; 2053-S.
Triodia pulchella H. B. K.—867-P; 1758-S; 1874-S; 1896-S; 1990-S; 2002-S.
Tripsacum lanceolatum Rupr.—Zacatón. 591-P; 1660-H; 1796-S; 1851-S; 601; 3336 M; 3604 G, S; 3751 G.

Cyperaceae

- Carex leucodonta* Holm—584 G, S; 2729 G, M, S.
Carex ultra Bailey—709 G, S.
Cyperus aristatus Rottb.—4790.
Cyperus aristatus var. *inflexus* (Muhl.) Boeckl.—2610.
Cyperus dipsaceus Liebm.—944 G, S.
Cyperus esculentus L.—2607 C, G, M, S.
Cyperus Fendlerianus Boeckl.—4782
Cyperus flavus (Vahl) Nees—1109 G, S; 3223 C, G, M, S; 4728.
Cyperus Manimae H. N. K. var. *asperimus* (Liebm.) Kükent.—2640 G, M, S.
Cyperus odoratus L.—780 G, S.
Cyperus uniflorus Torr. & Hook.—587-P; 3098 G, M, S; 3263 G, M, S.
Cyperus sp.—1969-S; 1970; 1972.
Eleocharis acicularis (L.) R. & S.—2967 G, S.
Eleocharis nodulosa (Roth.) Schult.—3094 G, M, S.

Eleocharis palustris (L.) R. & S. Ciénaga. 1098 G, S.
Stenophyllus capillaris (L.) Britt.—2745 G, M, S.

Palmae

Washingtonia Sonorae Wats.—590-P.

Lemnaceae

Lemna minor L.—4415.

Bromeliaceae

Hechtia montana Brandeg.—541 G, S.
Tillandsia recurvata L.—514-P; 847-P; 2764 G, M, S; 3269 G, M, S; 3641 G, M, S;
 3804 G.

Commelinaceae

Commelina crispa Woot.—613 C, G, S; 2662 G, M, S; 3243 C, G, M, S; 3327 G, S;
 3955; 4618.
Commelina dianthifolia Delile—629-P; 951 G, S; 2596 G, M, S; 4258.
Commelina sp.—4798.
Tradescantia pinetorum Greene—991 C, S; 2609; 2726 G, M, S; 3246; 3478; 4259.
Tradescantia sp.—4773.

Juncaceae

Juncus saximontanus A. Nels.—720 S.
Juncus interior Wiegand—4409 M, US; 4836 M, US.
Juncus macer S. F. Gray—721.
Juncus Torreyi Cov.—Tulito. 710 S.

Liliaceae

Allium cernuum Roth—4387 M.
Allium scaposum Benth.—995 S; 3947.
Anthericum Torreyi Baker—652-P; 932; 9963; 2554 C, G, M, S; 2740 G, M, S;
 3183; 3998 M; 4235; 4264; 4831.
Asparagus officinalis L.—752.
Dasyllirion Wheeleri Wats.—Sotol. 575 G, S; 3064 G, M, S; 3234 G, M, S; 3555
 G, M, S; 4216; 4480.
Milla biflora Cav.—2569 G; 2652 G, M, S; 4152; 4244; 4263.
Nolina microcarpa Wats.—Palmilla. 4200.
Smilacina racemosa (L.) Desf.—3283 G, M, S.
Yucca Schottii Engelm.—Dátil.—584-P; 1119 G, S; 3128 G, M, S; 4217.
Zygadenus paniculatus (Nutt.) Wats.—4121a.

Amaryllidaceae

Agave Hartmani Wats.—Amole. 2820 G, M, S.
Agave Palmeri Engelm.—Lechuguilla. 517 G, S.
Agave Parryi Engelm.—Lechuguilla. 3920 M; 4580 M.
Agave Schottii Engelm.—amol, amolillo. 628 S; 4466 M; 4721 ?
Hypoxis sp.—4774.

Iridaceae

Sisyrinchium sp.—4236.
Tigridia Pringlei Wats.—580-P; 3468; 4250; 4839.

Orchidaceae

Habenaria sparsiflora Wats.—3466 G, M, S.
Hexalectria apicata (Walt.) Barnhart—4348.
Malaxis corymbosa Kuntze—3280 G, M, S; 4312a; 4351.

Saururaceae

Anemopsis californica Hook. & Arn.—Hierba del manso. 410 G, S; 3901 G, M, S.

Salicaceae

Populus acuminata Rydb.—Huérigo. 4705 M.
Populus angustifolia James—740-P.

- Populus Fremontii* Wats.—Alamo. 429 G, S; 2614 G, M, S; 2935 G, M; 3396 G, M, S; 3537 G, M, S; 3863; 4128; 4679.
Populus monicola Brandeg.—Huérigo. 691 G, S.
Populus Palmeri Sarg.—357 G, S.
Populus tremuloides Michx.—4817 C, G, M, S.
Salix Bonplandiana H. B. K.—3530 G, M, S, US.
Salix Bonplandiana var. *Toumeyii* Schneid.—Sauce. 609 G, S, US; 618 G, S, US; 2833 C, G, M, S, US; 3944 C, G, M, S.
Salix Goodingii Ball var. *vallicola* (Dudley) Ball—Sauce, sauz. 428 G, S; 2615 G, M, S; 2881 G, M, S; 2973 G, M, S; 3862 G, M, S; 4102 C, G, M, S.
Salix jaliscana Jones—Jarilla. 3312 C, G, M, S.
Salix lasiolepis Benth. var.—Sauz. 3397 G, M, S; 4276 C, G, M, S.
Salix taxifolia H. B. K.—Taraiz. 331-P; 2990 G, M, S; 3726 G, M, S; 4221 C, G, M, S.

Juglandaceae

- Juglans major* (Torr.) Heller—Nogal. 464, G, M, S; 499; 2616 C, G, M, S; 2824 G, M, S; 2875 G, M, S; 2925 G, M, S; 2971 G, M, S; 2994 G, M, S; 3496 G, M; 3527 G, M, S; 4161 C, G, M, S; 4704 M.

Betulaceae

- Alnus oblongifolia* Torr.—Alamillo, jucaro. 496 G, S; 2808 G, M, S; 2965 G, M, S; 3116 G, M, S; 3481 G, M, S.
Ostrya virginiana (Mill.) Koch—Jucaro. 583 G, S; 605; 3388 G, M, S; 3504 G, S.

Fagaceae

- Quercus albaefolia* C. H. Mull.—3480 G, M, S; 4349 M; 2827 G, M, S.
Quercus arizonica Sarg.—Encino azul, encino blanco. 501 G, S; 943 G, S; 496 G, S; 2511 G, M, S; 2746 C, G, M, S; 2798 G, M, S; 3150 G, M, S; 3200 G, M, S; 3371 G, M, S; 3944 C, G, M, S; 4219 G, M, S; 4375, G, M, S; 4371 G, M, S; 4825, G, M, S.
Quercus chihuahuensis Trel.—Encino chino. 2932 G, M, S; 3124 G, M, S; 3616 G, M, S; 3965 C, G, M, S.
Quercus diversicolor Trel.—Encino. 3202 G, M, S; 3382 G, M, S; 4197 C, G, M, S; 4308 G, M, S; 4786 G, M, S; 4826 G, M, S.
Quercus Emoryi Torr.—Bellota, encino. 942 G, S; 2549 G, M, S; 4689 C, G, M, S; 2799 G, M; 3233 G, S; 3921 C, G, M, S; 3931 G, M, S; 4075 G, M, S; 4251 G, M, S; 4658, G, M, S.
Quercus Endlichiana Trel.—Encino hueja. 3193 G, M, S.
Quercus fulva Liebm.—Encino hurja. 3358 G, S.
Quercus hypoleucoides A. Camus—Encino colorado. 502; 2727 C, G, M, S; 2826 G, M, S; 3151 G, M, S; 3372 G, M, S; 4251 C, G, M, S; 4737 G, M, S.
Quercus oblongifolia Torr.—Encino azul. 2688 C, G, M, S; 3911 C, G, M, S; 4645 G, M, S; 4731 G, M, S.
Quercus Toumeyii Sarg.—Encino chaparro. 572 G, S; 958 G, S; 2742 G, M, S; 2819 G, M, S; 3051 C, G, M, S; 3173 G, M, S; 3212 G, M, S; 3940 G, M, S; 4220 C, G, M, S; 4741.
Quercus viminea Trel.—Bellota, encino. 526 G, S; 566 G, S; 568 G, S; 2743 C, B, M, S; 3370 G, M, S.

Garryaceae

- Garrya Wrightii* Torr.—573 G, S; 4096; 4378 C, G, M, S; 4640 G, M, S.

Ulmaceae

- Celtis pallida* Torr.—Garambullo. 323-P; 408 G, S; 437 G, S; 3065 G, M, S; 3532 G, M, S; 3889 M; 4021 M; 4435 G, M, S; 4566 C, G, M, S.
Celtis reticulata Torr. Cumaro. 394 G, M, S; 441 G, S; 1118 G, S; 2588 G, S; 2894 G, M, S; 2974 G, M, S; 3000 G, M, S; 4105 C, G, M, S.

Moraceae

- Ficus Carica* L.—Higuera. 380 G, S.
Ficus petiolaris H. B. K.—Texcalama. 383; 2910 G, S.
Morus microphylla Buckl.—Salsamora. 2893 G, M; 2925-a G, A; 3749 G, M, S; 4847.
Morus alba L.—Mora. 452 G, S.

Loranthaceae

- Phoradendron Bolleanum* (Seem.) Eichl.—3926 C, G, M, S.
Phoradendron Coryae Trel.—Toji. 2801 G, M, S; 3992 C, G, M, S.
Phoradendron juniperinum Engelm.—Toji. 3623 G, M, S; 3867 C, G, M, S; 4240 G, M, S.
Phoradendron macrophyllum Cockerell—1121 S; 2553 G, M, S.

Santalaceae

- Comandra pallida* A. DC.—607 G, S.

Aristolochiaceae

- Aristolochia brevipes* Benth.—1088?
Aristolochia Watsoni Woot. & Standley—Hierba del indio. 643.

Polygonaceae

- Antigonon leptopus* Hook. & Arn.—San Miguelito. 340.
Eriogonum Abertianum Torr.—475-P; 763-P; 816-P; 459; 653; 655; 668 G, S; 2515 G, M, S; 2664 C, G, M, S; 3040; 3111 G, S; 3236; 3241 G, M, S; 3260 M; 3898 M; 3916 M; 4039 M, S; 4331 M; 4429 M; 4442 M; 4474 M; 4639.
Eriogonum Ainsliei Standley—Escobita de la virgen. 1110 G, S.
Eriogonum Jamesii Benth.—4293; 4742.
Eriogonum polycladon Benth.—Escobita de la virgen. 2516 G, M, S.
Eriogonum Brightii Torr.—2556; 2587 G, S; 4646; 4720 M.
Eriogonum sp.—3795 M, S.
Polygonum amphibium L.—2960; 3686 M, S.
Polygonum aviculare L.—3415 G, M; 4072.
Polygonum Hydropiper L.—Chilillo. 435 S; 645 G, S.
Polygonum hydropiperoides Michx.—Chilillo. 298.
Polygonum lapathifolium L.—Chilillo. 830-P; 701 G, S; 3249 G, M, S; 3775 G, S; 4103; 4324.
Rumex altissimus Wood.—Cañaire. 2877 G, M, S.
Rumex crispus L.—Cañaire. 2749 G, M; 3362 G, M, S.
Rumex hymenosepalus Torr.—4294 M.
Rumex mexicanus Meisn.—Hierba colorada. 458 G, S; 651; 670; 2958 G, S.
Rumex salicifolius Weinm.—Cañaire. 3363 G, M, S.

Chenopodiaceae

- Atriplex canescens* (Pursh) Nutt.—782 G, S; 3846 M; 4141; 4475.
Atriplex elegans (Moq.) D. Dietr.—639; 4106.
Chenopodium ambrosioides L.—Nipasote. 457 G, S; 704 G, S; 2946 G, M, S.
Chenopodium Berlandieri Moq.—Chual. 449 S; 2890 G, M; 3356 G, M, S.
Chenopodium Fremontii Wats.—Chual. 2513 G, M, S; 3187 G, M; 3298 M; 4037 M; 4443 M; 4695 M.
Chenopodium glaucum L.—3864 M.
Chenopodium incanum (Wats.) Heller—4117-a.
Chenopodium incisum Poir.—4405; 4478 M; 4829.
Chenopodium leptophyllum Nutt.—Chual. 2959 G, M, S.
Chenopodium Palmeri Standley—4117?

Amarantaceae

- Amaranthus blitoides* Wats.—4656.
Amaranthus hybridus L.—Bledo, quelite. 447 G, S; 1102 G, S; 3393 G, M, S; 3806 G, M.
Amaranthus Palmeri Wats.—Bledo, quelite. 762 G, S; 1113 G, S; 2519 G, S; 2731 G, S; 2889 G, M, S; 3962 M; 4107.
Amaranthus Powellii Wats.—4386 M.
Froelichia gracilis Moq.—2517.
Froelichia interrupta (L.) Moq.—1095 S.
Gomphrena caespitosa Torr.—4708.
Gomphrena decumbens Jacq.—3086.
Gomphrena nitida Rothr.—829-P; 2508 G, M, S; 2667 G, M, S; 4401.
Gomphrena Sonorae Torr.—471-P; 472-P; 762-P; 2774 G, M, S; 2785 G, M, S; 2929 G, S; 3058 G, S; 3553 G, M, S; 3620 G, S; 3966 M; 4025 M; 4157; 4471 M; 4682 M.

Guilleminea densa (Willd.) Moq.—3087 G, M, S; 3278 G, M, S; 3514 G, M, S; 3933 M.
Iresine paniculata (L.) Kuntze—3248 G, M, S; 4664.
Tidestromia lanuginosa (Nutt.) Standley—4145; 4479.

Nyctaginaceae

Allionia incarnata L.—765-P; 446 S; 612 M; 2942; 3068 G, M, S; 3839 M, S; 3958 M, S; 4030 M, S; 4464 M; 4478 M; 4515 M, S; 4579 M, S.
Boerhaavia caribaea Jacq.—Juanilipili. 327-P; 751-P; 356; 443; 676 S; 905 G, S; 2530 G, M, S; 2546 G; 2961 G, M, S; 3316 M, S; 3649 G, M, S; 3744 G, M, S; 3844 M, S; 3961 M, S; 4146 S; 4698 M, S.
Boerhaavia Coulteri (Hook. f.) Wats.—Juanilipili. 4136.
Boerhaavia erecta L.—641; 662; 671; 2507 G, M, S; 2676 G, M, S; 2943 G, M, S; 3666 G, M, S; 3885 M, S; 3983 M, S; 4483 M; 4689.
Boerhaavia gracillima Heimerl—3338 G, M.
Boerhaavia intermedia M. E. Jones—687 S; 771; 3524 G, M, S; 4433 M, S;
Boerhaavia spicata Choisy—686; 3740 G, M, S; 4028 M, S; 4605 M, S.
Boerhaavia Torreyana (Wats.) Standley—2677.
Commicarpus scandens (L.) Standley—334-P; 849-P; 742 C, S; 775 C, G, S; 3265 G, M, S; 3566 M, S; 4421 M, S; 4663 M; 4688 M, S.
Mirabilis corymbosa Cav.—2710 G, M, S.
Mirabilis Jalapa L.—3400 M, S.
Mirabilis Wrightiana Gray—Maravilla. 2585 C, G, M, S; 2969; 3275 G, M; 3736 G, S; 4423 M. Nos. 2585 and 3275 were incorrectly labeled. M. Wrightii Gray.
Oxybaphus coccineus Torr.—3884.
Oxybaphus comatus (Small) Weatherby—994; 4292 M; 4767.
Oxybaphus linearis (Pursh) Robins.—1091 S; 2537 G, S.

Phytolaccaceae

Phaulothamnus spinescens Gray—Tútuqui. 413 S; 4529 M.
Phytolacca americana L.—427-P?; 3386 G, M, S.
Rivina humilis L.—739 S; 2885 G, M, S; 3018 G, M, S; 3074 M, S; 3244 G, M, S; 3756 G, M, S; 3383; 3101 C, G, S; 4436 G, M, S; 4683.

Aizoaceae

Mollugo verticillata L.—4168; 4545 M; 4712 M.

Portulacaceae

Portulaca lanceolata Engelm.—3881; 4057; 4088 M, S.
Portulaca oleracea L.—Verdolaga. 434.
Portulaca retusa Engelm.—4118.
Portulaca suffrutescens Engelm.—665; 2564; 3071 G, M, S; 3299; 4056 S; 4399.
Portulaca sp.—4813; 4814; 4879.
Talinum aurantiacum Engelm.—3562 G; 3859; 3893; 4468; 4713.
Talinum confertiflorum Greene—3976.
Talinum paniculatum (Jacq.) Gaertn.—469-P; 766-P; 2769 G, M, S; 3066 G, M, S; 3242 G, M, S; 3792 M; 4109 M, S; 4437 M, S; 4725.
Talinum sp.—4859.

Caryophyllaceae

Arenaria saxosa Gray—3181 G, M, S.
Cerastium nutans Raf.—409-P; 672-P; 2845.
Drymaria effusa Gray (2)—4766?
Drymaria nodosa Engelm.—2557 G, M, S; 4125; 4403.
Drymaria sperguloides Gray—970.
Drymaria tenella Gray—2733 C, G, M, S.
Silene antirrhina L.—723.
Silene laciniata Cav.—411-P; 653-P; 3452 G, M, S; 3506 G, M, S; 4257 S.
Silene Thurberi Wats.—2755 G, M, S; 3296 G, S; 4172; 4393; 4673 M; 4727 M.

Ranunculaceae

Aquilegia chrysantha Gray—2797; 2811.
Aquilegia formosa Fischer—644-P.
Clematis Drummondii Torr. & Gray—Barba de chivo, barba de viejo. 297; 326 G, M, S; 424; 2593 C, G, M, S; 2765 G, M, S; 2867 M, S; 2978 G, M, S; 3294; 3375 G, M, S; 3835 G, M, S; 3986 C, G, M, S; 4126 C, G, M, S.

- Ranunculus arizonicus* Lemmon ex Gray—3129 ? G, M, S.
Ranunculus Hookeri Schlecht.—3902.
Ranunculus trichophyllus Chaix—2957 C, G, M, S; 3682 G, M, S.
Thalictrum Fendleri Engelm.—2928 G; 3081 G, M, S; 3149 G, M, S; 3465 G, M, S;
 4051 M; 4394 M.
Thalictrum occidentale Gray—3054 G, M, S.

Berberidaceae

- Mahonia haematocarpa* (Woot.) Fedde—Palo amarillo. 4628 C, G, M, S; 4696 G, M, S.
Mahonia trifolia Cham. & Schlecht.—3681 M, S.
Mahonia Wilcoxii (Kearney) Rehder—661-P.

Menispermaceae

- Cocculus diversifolius* DC.—387 S; 438 G, M, S; 3034 G, M, S; 4120 G, S.

Papaveraceae

- Argemone alba* Lest.—325 G, S; 420 G, S; 790 G, M, S; 2977 G, M, S.
Argemone intermedia Sweet—3852 ?
Papaver somniferum L.—Amapola, amapolita. 2876.

Cruciferae

- Brassica nigra* (L.) Koch—Mostaza. 2871 G, M, S.
Draba petrophila Greene—4395.
Erysimum asperum DC.—4634 M, S.
Hesperidanthus linearifolius (Gray) Rydb.—706; 2525 G, M, S; 2690 G, S; 3017 G;
 3052 G, M, S; 3093 G, M, S; 3140 G, M, S; 3185 G, M, S; 3226 G, S; 3230; 3366
 G, S; 3938; 4268; 4644; 4671. Some of the above numbers were distributed as
Sisymbrium and *Thelypodium*.
Lepidium Eastwoodiae Woot.—Pamita cimarrón. 440; 638 S; 2865; 2941 G, M, S;
 3037 G, M, S; 3818; 3869 M, S.
Lepidium virginicum L. var. *pubescens* C. L. Hitchc.—2856.
Pennellia micrantha (Gray) Nieuwland—541-P; 3053 G, M, S; 3215 G, M, S; 3253 G;
 3367; 3494.
Radicula Nasturtium-aquaticum (L.) Britt. & Rendle—769.

Capparidaceae

- Polanisia uniglandulosa* (Cav.) DC.—432 G, M, S; 2869 G, M, S; 4651.
Wislizenia refracta Engelm.—3845 M.

Crassulaceae

- Graptopetalum occidentale* Rose—1733-H; 4160; 4223; 4307; 4337; 4844; 4857. All of
 the above are live plants growing in the Botanical Gardens of the University
 of Michigan. Only 1733-H has flowered permitting certain determination,
 but probably no more than one species is represented.
Sedum stelliforme Wats.—785-P ?

Saxifragaceae

- Fendlera rupicola* Gray—626 G, S; 3273 G, M, S.
Fendlera Wrightii (Gray) Heller—530 G, S; 3055 G, M, S; 3095 G, M, S; 4296 M;
 4636 M.
Fendlerella utahensis (Wats.) Heller—4317 G, M, S.
Heuchera parviflora Nutt.—643-P.
Heuchera sanguinea Engelm.—655-P; 2712 G, M, S; 3287 G, S; 3678 G, M, S; 4082
 C, G, S; 4305 G, M, S; 4734.
Philadelphus serpyllifolius Gray—423-P.

Platanaceae

- Platanus Wrightii* Wats.—Sliso. 498 G, S; 2503 G, M, S; 2591 C, G, M, S; 2756
 2802; 2996 G, M, S; 3491 G, M, S; 4413 C, G, M, S.

Crossosomataceae

- Crossosoma Egelovii* Wats.—678 G, S; 3517 C, G, M, S; 4850 C, S.

Rosaceae

- Agrimonia striata* Michx.—639-P; 3351 G, M; 4354 C, G, M, S.
Cercocarpus eximius (C. Schneid.) Rydb.—574 G, S; 590 G, S; 3142 G, M, S; 4241 G, S; 4736 G, M, S.
Cowania Slansburiana Torr.—Poño. 840-P; 598.
Fallugia paradoxa (Don) Endl.—2548 G, M, S; 2594 G, M, S.
Potentilla atrorubens Rydb.—408-P; 3188 G, M; 3350 G, M, S; 4189 G, S.
Prunus virens (Woot. & Standley) Shreve—Capulin. 2509 G, M, S; 2790 G, M, S; 3127 G, M, S; 3159 G, M, S; 3348 G, M, S; 4237 C, G, M, S.
Pyrus communis L.—753 G, S.
Rubus strigosus Michx.—630-P ?
Rubus sp.—Freza silvestre. 3189 G, M, S.
Spiraea dumosa Nutt.—685-P; 3199 C, G, M, S; 4184 C, G, M, S; 4256 C, G, S; 4785.

Leguminosae

- Acacia angustissima* (Mill.) Kuntze—2555 G, M, S; 2584 C, G, M, S; 3488 G, M, S; 4719 M, S.
Acacia constricta Benth.—Binorama. 845-P; 633 G, M, S; 2862 G, M, S; 3868 C, G, M, S; 4130 S.
Acacia crinita Brandeg.—3963 M, S.
Acacia cymbispina Spreng. & Riley.—Huínole. 2767.
Acacia filicoides (Cav.) Trel.—2624 G, S; 4328.
Acacia Greggii Gray—Tésota. 453 G, M, S; 4563 M; 4597.
Acacia millefolia Wats.—339 G, M, S; 539 G, M, S; 679 G, M, S; 2860 M; 3002 G, M, S; 3019 G, M, S; 4034 S; 4511 M, S; 4609 M, S.
Acacia pennatula (Schlecht. & Cham.) Benth.—Chirahui. 403 G, M, S; 408 G, M, S.
Acacia vermicosa Standley—3817 M, S.
Amorpha occidentalis Abrams—4412 M, S.
Astragalus Wootoni Sheldon—2964 G.
Benthamantha Edwardsii (Gray) Rose—3118 G, M, S; 3497 C, G, M, S; 4098.
Benthamantha glabella (Gray) Rydb.—2737.
Benthamantha Wrightii Rydb.—2602 C, G, M, S; 2651 G, M, S.
Caesalpinia Gilliesii (Hook.) Wall.—418 C, G, S; 4556.
Caesalpinia pulcherrima (L.) Swarts—395 G, M, S; 2934.
Calliandra eriophylla Benth.—4623 S.
Calliandra formosa (Kunth) Benth.—3609 C, G, M, S.
Calliandra humilis (Schlecht.) Benth.—3917 M.
Calliandra reticulata Gray—525 S; 3076; 4350 M, S.
Cassia bauhinoides Gray—2568 G, S; 3841 M, S. The root of this species has a rhubarb odor.
Cassia Covesii Gray—Hojasén. 431 S; 455 S; 4122 S; 4543 M, S.
Cassia leptadenia Greenm.—2540 G, M, S; 2620 C, G, M, S; 3503 G, M, S; 3791; 3973 M, S.
Cassia leptocarpa Benth.—Hierba del piojo. 2567 C, G, M, S; 2789 G, M, S; 2868 G, M; 3056 G; 3254 G, S; 3520 G, M, S; 3615 G, M, S; 3729; 4554 M, S.
Cassia Lindheimeriana Scheele—3525 G, M, S.
Cassia Wislizeni Gray—3853 C, G, M, S.
Cassia Wrightii Gray—625; 2738 C, G, M, S; 3012 G, S; 3077; 3272 G, M, S; 3633 G, M, S; 3927 M, S.
Cercidium praecox (R. & P.) Harms—Brea. 663; 4032.
Cologania angustifolia Kunth—3406; 3411; 3472; 4254.
Cologania Lemmonii Gray—3164a; 3172 ? ; 3399 C, G, M, S; 3405 G, S; 4253.
Cologania longifolia Gray—2599 G, M, S; 2840; 3139 G; 3250; 3207; 3935; 4255.
Crotalaria longirostrata Hook. & Arn.—523-P; 3308; 3519 C, G, M, S; 4086 M, S.
Crotalaria pumila Ortega—Hierba loca, tronader. 2619 C, G, M, S; 3669 M, S; 3712 G, M, S.
Crotalaria sagittalis L. 2735 C, G, M, S; 3637; 3653; 4370 M, S.
Crotalaria vitellina Ker-Gawl.—3105; ? 3255 ?
Dalea albiflora Gray—3489 G, M, S; 4181 S.
Dalea astragalopsis Standley—3180 S.
Dalea diffusa Moric.—2687 G, M, S; 3707 G, M, S; 3946 M, S.
Dalea filiformis Gray—4297 M, S.

- Dalea filiformis* Gray var.—2725 C, G, M, S.
Dalea Grayi Vail—2579 C, G, M, S; 2686.
Dalea lachnostachys Gray—843-P.
Dalea lagopina Rydb.—4806 M, S.
Dalea leporina (Ait.) Kearney & Peebles ex Hemsl.—2705 G, M, S.
Dalea Lumholtzii Robins. & Fern.—Limoncillo, té limón. 557-P; 945 G, S; 2521 G, M, S; 3192 G, M, S; 3484 G, M, S; 4179 S. This species has a lemon-like odor, and may be used either fresh or dry for making tea.
Dalea mollis Benth.—4589.
Dalea Ordiae Gray—2580 ? C, G, M, S; 4716 M, S.
Dalea Parryi Torr. & Gray—4591 ? M, S.
Dalea pogonathera Gray—2851.
Dalea Wrightii Gray—4148 S.
Desmanthus bicornutus Wats.—3598 G, M, S; 4033.
Desmodium arizonicum Wats.—3404; 3430 G, M, S; 3485 G, M, S.
Desmodium batocaulon Gray—969 G, S; 2523 G, M, S; 2541 G, S; 2622 C, G, M, S; 3667 H, S; 3742 G, S; 3999 M.
Desmodium cinerascens Gray—2532 C, G, M, S; 3585 C, G, M, S.
Desmodium gramineum Gray—522-P; 3632 C, G, M, S.
Desmodium neomexicanum Gray—971; 2621 C, G, M, S; 3437; 3285 M.
Desmodium prehensile Schlecht.—820-P; 3398 G, M, S; 3435 G, M, S.
Desmodium purpureum (Miller) Faw. & Rendle—2623 C, G, M, S; 2757 G, M, S.
Desmodium Rosei Schubert—2539 G, M, S; 3665 G, M, S.
Desmodium sp.—2987 G, M, S.
Diphysa Thurberi (Gray) Rydb.—2625 C, G, M, S; 4079 M, A.
Eriosema laetum Johnston—2650 G, M, S.
Erythrina flabelliformia Kearney—Chilicote. 379 G, S; 507; 2761; 2813; 3126 G, M; 4097; 4757.
Eysenhardtia orthocarpa (Gray) Wats.—Palo dulce. 490; 5083; 3078 G, S; 3554 G, M, S; 3887 C, G, M, S; 4512 M, S; 4648 M, S.
Eysenhardtia polystachya (Ort.) Sarg.—535 ? S; 2821 ? M, S. Lvs. in these are 9 21 foliolate, and more pubescent than in typical *E. polystachya*.
Galactia striata (Jacq.) Urban—4568.
Galactia Wrightii Gray—3007 G; 3119 G, M, S; 3262 G, M, S; 3900 M, S; 4657 M, S.
Hoffmanseggia densiflora Benth.—904 S; 2611 C, G, M, S; 3825.
Indigofera sphaerocarpa Gray—4677 M.
Lathyrus arizonicus Britt.—3436 G, M, S.
Lotus chihuahuanus (Wats.) Greene—2586 G, M, S; 3340 G, M, S.
Lotus neomexicanus Greene—2831 ?
Lotus puberulus (Benth.) Greene—2837 G, M, S; 3106 G, M, S; 3132 G, M, S; 3274 G, S.
Lotus Wrightii (Gray) Greene—564; 599 C, G, S; 966 G, S; 4201 S; 4729 M, S; 4805, M. S.
Lysiloma microphylla Benth.—Mauto. 397 G, M, S; 3808 M, S.
Lysiloma Watsoni Rose—Tepeguaje, tepehuaje. 396 G, S; 622 G, S; 2783 G, M, S; 3020 G, M, S; 3538 G, M, S.
Melilotus indica (L.) All.—Trebol. 303; 2901 G, M, S.
Mimosa biuncifera Benth.—2978 G, M; 3643 M, S; 3801 G, M, S; 3834 M, S.
Mimosa dysocarpa Benth.—4675 M, S.
Mimosa Grahami Gray—3668 G, M, S; 4295.
Mimosa laxiflora Benth.—3564 C, G, M, S; 4035; 4533 M, S.
Mimosa Wrightii Gray—Gatuño. 579 S; 3006 G, M, S; 3227 G, M, S; 3892 S; 3972 M, S; 4678.
Nissolia Pringlei Rose—3035 G, M, S.
Nissolia Schottii (Torr.) Gray—543-P; 534 G, S; 734 G, S; 3075 G, M, S; 3268 G, M, S; 3557 G, S; 3587 G, M, S; 3886 G, M, S; 4524 C, G, M, S.
Parkinsonia aculeata L.—Bagota. 355 G, S.
Petalostemon exilis Gray—4383 M.
Petalostemon oligophyllus (Torr.) Rydb. 824-P.
Petalostemon Sonorae Rydb.—842-P.
Phaseolus acutifolius Gray—4613.
Phaseolus angustissimus Gray—838-P.
Phaseolus angustissimus var. *latus* M. E. Jones—3419 G, S.
Phaseolus heterophyllus Willd.—2542 C, G, M, S; 4062 S; 4186 S; 4777.

- Phaseolus Metcalfei* Woot. & Standley—Coeolmeca. 3453 G.
Phaseolus ritensis Jones.—2707 C, G, S; 3408 G; 4369 M.
Phaseolus vulgaris L. Frijol. 3919.
Phaseolus Wrightii Gray—636-P; 2561; 3083 G; 3148 G, M, S; 3438 G, M, S. 2561 and 3038 were distributed as *P. heterophyllus* Willd.
P. Wrightii var. *Grayanus* (Woot. & Standley) Kearney & Peoples 3473 C, G, M, S.
Pithecollobium mexicanum Rose—Chino. 386 G, S; 3003 G, M, S; 3802 M.
Prosopis chilensis (Mol.) Stuntz—Mesquite. 402 G, S; 419 G, S.
Rhynchosia pyramidalis (Lam.) Urban—Antipusi. 2919 G, M, S.
Rhynchosia texana Torr. & Gray—4488.
Robinia neomexicana Gray—660-P; 4803. These were distributed as *R. luxurians* (Dieck.) Rydb.
Tephrosia leiocarpa Gray—3008; G, M, S; 3626 C, M, S.
Tephrosia purpurea (L.) Pers.—3583 C, G, M, S.
Tephrosia Thurberi Gray—2706 C, G, M, S; 3225 C, G, M, S; 3502 C, G, M, S.
Trifolium lacerum Greene—1099 G, S; 3353 C, G, M, S.
Vicia leucophaea Greene—3208 G, M, S.
Vicia pulchella H. B. K.—2848 G; 3138 C, M, S; 3354 C, G, M, S; 4316 M, S.
Zornia diphylla (L.) Pers.—3082; 3594; 4149.

Krameriaceae

- Krameria Grayi* Rose & Painter—Mamelique. 2816 G, M, S; 2954 G, M, S; 3042 G, M, S; 3270 G, M, S.
Krameria parvifolia Benth.—Tamichi. 624 S; 2786 G; 3642 G, S; 3924 M; 4151; 4528 M; 4592 G, M, S.
Krameria paucifolia Rose—3896 G, S.

Geraniaceae

- Geranium atropurpureum* Heller—3133 G, M, S; 3343 G, M, S; 4182 C, G, M, S.
Geranium Wislizeni Wats.—2719 G, S; 3147 G, M, S; 3314; 3342 G, M, S; 3978 C, G, M, S; 4198 C, G, M, S.

Oxalidaceae

- Oxalis albicans* H. B. K.—757-P; 306 S; 577; 968 S; 2544 G, S; 2545 G, S; 3330 G, S.
Oxalis divergens Benth.—3201 C, G, M, S.
Oxalis Grayi (Rose) Kunth—2907; 3146 C, G; 4252.
Oxalis stricta L.—544-P; 4058.
Oxalis violacea L.—3460.
Oxalis sp.—4797.

Linaceae

- Linum hypericifolium* Presl—3458 C, G, M, S.
Linum neomexicanum Greene—3196 C, G, M, S; 3322; 3377 G; 3439 G, M, S; 4199; 4849.
Linum puberulum (Engelm.) Heller—4061.

Zygophyllaceae

- Kallstroemia californica* (Wats.) Vail—634 G, S; 4615 M.
Kallstroemia grandiflora Torr.—Baiburin, San Miguelito. 854-P; 766; 2512; 2986 G, M, S; 3027 G; 3029 G, M, S; 3785; 3866; 3967; 4108; 4469 M.
Kallstroemia laetivirens Thornber—686; 2527 G, M, S.
Kallstroemia longipes Rydb.—781 ? ; 3551 ?
Larrea divaricata Cas.—3819 G, M, S; 4131 G, M, S; 4558 C, G, M, S.
Tribulus terrestris L.—4042; 4112.

Rutaceae

- Esenbeckia Hartmanii* Robins. & Fern.—Samota. 2921 ? G, M, S.
Ptelea trifoliata L.—Fresno. 506 G, S; 3009 G, M, S.

Simaroubaceae

- Ailanthus glandulosa* Desf.—754 G, S.

Burseraceae

- Bursera confusa* (Rose) Engler.—Torota. 3625 G, M, S; 3959.
Bursera laxiflora Wats.—Torota prieta, palo mulato. 384 G, S; 399 G, S.

Meliaceae

Melia Azedarach L.—Lila, piocha. 421 S.

Malpighiaceae

Aspicarpa hirtella Tich.—3476 G; 3997; 4063; 4158.

Janusia californica Benth.—546; 3271 G, M, S; 3629 G, M, S.

Janusia gracilis Gray—683 G, S; 3080 G, S; 3894 M, S; 4493 M, S; 4569 M, S.

Mascagnia cana Small—Gallinita. 482.

Mascagnia macroptera (Moc. & Sessé) Niedenzu—Gallinita. 391; 486.

Thryallis angustifolia (Benth.) Kuntze—3574 G, M, S.

Polygalaceae

Monnina Wrightii Gray—2724 G, M, S.

Polygala alba Nutt.—3703.

Polygala hemipterocarpa Gray—524; 2570 G; 2817; 3922.

Polygala macradenia Gray—4523; 4581 M.

Polygala obscura Benth.—952 G, S; 2595 C, G, M, S; 2698; 3240; 3376; 3923.

Polygala scoparioides Chodat—608.

Euphorbiaceae

Acalypha Lindheimeri Muell. Arg.—1097 G, S; 3702 G, S.

Acalypha neomexicana Muell. Arg.—2680 G, M, S; 4089; 4138 S.

Acalypha ostryaefolia Riddell—3716 G, M, S; 3960; 4137.

Acalypha papillosa Rose—392; 511 G, S; 2812 G, M, S; 2931 G, M, S; 2999 G, M, S; 3001 G, M, S; 3026 G, M, S; 3237 G, M, S; 3552 G, M, S; 3769 G, M, S; 3956 M.

There is considerable variation in the above specimens and perhaps more than one species is represented.

Acalypha phleoides Ca.—2497 G, M, S; 2546 G, M, S; 2655 C, G, M, S.

Bernardia myricaefolia Wats.—4870.

Cnidoscolus angustidens Torr.—Ortiguilla, ortija. 518; 531 G, S; 2695 C, G, M, S; 3634 G, M, S; 3913 M, S.

Croton corymbulosus Engelm.—4583.

Croton texensis (Klotzsch) Muell. Arg.—Hierba de la tórtola, tortolita. 327 G, S; 2873 G, M, S; 2939 G, M, S; 3685 M, S; 3885 M, S; 4144 S.

Dilaxis neomexicana (Muell.) Arg. Heller—4428 M.

Dilaxis serrata (Torr.) Heller—4502; 4601; 4861.

Euphorbia Abramsiana Wheeler—Golondrina. 642 S.

Euphorbia albomarginata Torr. & Gray—Golondrina. 632 S; 3855 M, S; 3914 M, S.

Euphorbia arizonica Engelm.—463; 3046 G, S; 4448 M; 4726 M, S; 4863.

Euphorbia capitellata Engelm.—851-P; 4565-a; 4603; 4864; 4865.

Euphorbia chamaesula Boiss.—4071 S.

Euphorbia colorata Engelm.—2648 G, M, S; 3646 G, S.

Euphorbia dentata Michx.—2583 G, S.

Euphorbia dentata var. *cuphosperma* Engelm.—Jumete. 4074; 4612; 4676.

Euphorbia dentata var. *lasiocarpa* Boiss.—2499 G, M, S.

Euphorbia exstipulata Engelm.—4714.

Euphorbia florida Engelm.—2685 G, S; 4027; 4565 M, S.

Euphorbia heterophylla L. sensu latiore—835-P; 2626 G, M, S; 2775 G, M, S; 3592 G; 3690 G, S; 4614; 4685 M, S.

Euphorbia hirta L. var. *procumbens* (DC.) N. E. Brown—2679 G, M, S.

Euphorbia hirta var. *typica* Wheeler—760 S; 3311; 3650; 3697; 4087 M, S; 4166 S; 4448 M, S; 4661 M, S; 4868.

Euphorbia hyssopifolia L.—2582 C, G, M, S; 3596 H; 3722; 3918 M, S; 4135 S; 4629; 4715.

Euphorbia indivisa (Engelm.) Tidestrom—2681 G, S; 3696; 4404.

Euphorbia micromera Boiss.—4535.

Euphorbia Parryi Engelm.—640 S.

Euphorbia Plummerae Wats.—Golondrina. 3198; 3220.

Euphorbia revoluta Engelm.—4446; 4503.

Euphorbia setiloba Engelm.—4476; 4860.

Jatropha cardiophylla (Torr.) Muell. Arg.—Sangregado. 661 G, S; 3578 G, M, S; 4019 M, S; 4482.

Jatropha cordata (Ortega) Muell. Arg.—Torota prieta, torota blanca. 404 G, S; 2924 G, M, S; 2925-b G, M, S.

Jatropha macrorrhiza Benth. var. *septemfida* Engelm.—623 G, S; 3824 M, S.
Manihot angustiloba (Torr.) Muell. Arg.—542 G, S; 2758 G, M, S; 2930 G, M, S;
 3013; 3103; 3647.

Phyllanthus polygonoides Nutt.—3800.

Ricinus communis L.—Higuerilla. 296 G, S; 4610 M.

Sapium biloculare (Wats.) Pax—Hierba de la flecha. 401 G, S; 2916 G, M, S.

Tragia laciniata (Torr.) Muell. Arg.—Mala mujer. 586.

Tragia nepetaefolia Cav.—Ortiguilla. 954 S; 3163 C, M, S.

Anacardiaceae

Rhus choriophylla Woot. & Standley—Lima. 841-P; 2660, G, M, S; 2759 G, S;
 3988 G, M, S; 4380 C, G, M, S; 4692 G, M, S.

Rhus glabra L.—581 G, S; 3381 G, M, S.

Rhus microphylla Engelm.—Lima de la sierra, limita. 487 G, S; 736; 2861 G, M, S;
 3837 C, G, M, S; 4699 M.

Rhus Rydbergii Small—Hiedra. 497 G, S; 2551 G, M, S; 2763 G, M, S; 3295 G,
 M, S; 3505 G, M, S; 3990 M; 4238 M.

Rhus trilobata Nutt.—527 G, S; 2547 G, M, S; 2814 G, M, S; 3178 G, M, S; 3907
 C, G, M, S; 4239 G, M, S; 4732 G, M, S.

Rhus virens Lindh.—Lima. 528-P; 2805 G, M, S; 3235 G, M, S; 3648 G, M, S;
 3794 G, M, S.

Celastraceae

Mortonia scabrella Gray—520 G, S.

Aceraceae

Acer brachypterum Woot. & Standley—Palo azúcar. 500 G, S; 3011 G, M, S;
 3205 G, M; 3390 G, M, S; 4318 G, M, S.

Sapindaceae

Cardiospermum Halicacabum L.—748-P.

Dodonaea viscosa Jacq.—Tarachico, tarachique. 400 G, M, S; 514, G, M, S; 2800
 G, M, S; 2834; 2995 G, M, S; 3228; 3621 M, S; 4041 G, M, S; 4520 C, G, M, S.

Sapindus Saponaria L.—Chirrión. 504 G, S; 693 G, S; 3025 G, M, S; 3588 G, M, S.

Ungradiad speciosa Endl.—694 G, S; 4684 C, G, M, S.

Rhamnaceae

Ceanothus coeruleus Lag.—507-P.

Ceanothus Huichagorare Loesen.—Junco. 404-P; 635-P; 2850; 3425 G, S; 3912 M;
 4188; 4214.

Condalia lycioides (Gray) Weberb.—Bachata. 862-P; 417 G, S; 785 S.

Condalia spathulata Gray—818-P; 4487.

Rhamnus betulaeifolia Greene—Salicieso. 582 G, S; 2708 C, G, M, S; 3194 G, M, S;
 3499 G, M, S; 3695 G, M, S; 3979.

Rhamnus illicifolia Kellogg—4846. Sterile specimen from the only plant seen.

Vitaceae

Cissus trifoliata L.—318-P.

Parthenocissus quinquefolia (L.) Planch.—2899 G, M, S.

Vitis arizonica Engelm.—Parra. 505-P; 2665 C, G, M, S; 2736 C, G, M, S; 2825
 M, S; 3389 G, M, S; 4094 C, G, M, S; 4167 G, M, S; 4278 C, G, M, S.

Vitis cinerea Engelm.—Uva cimarrona. 2895 G, M, S; 2970 G, M, S; 4489.

Malvaceae

Abutilon californicum Benth.—4494 ? M.

Abutilon crispum (L.) Sweet—3044 G, M, S.

Abutilon incanum (Link) Sweet—4562 M.

Abutilon Pringlei Hochr.—4495 M.

Abutilon reventum Wats.—Limpiatuna. 467-P; 3518 G, M, S; 4163.

Abutilon Sonorae Gray—3277 G, M, S; 3748 M, S; 4681.

Anoda cristata (L.) Schlecht.—Quesito. 556-P; 825-P; 2627 G, M, S; 2673; 2892
 G, M, S; 4099; 4382 M.

Anoda hastata St. Hil.—2498 G, M, S; 3858.

Anoda Wrightii Gray—912 S.

- Anoda* sp.—3618 G, M, S.
Gossypium Thurberi Todaro—521 S; 2753 G, M, S; 3090 G; 3133 G, M, S; 3603 G; 3746 G, M, S; 4718 C, G, M, S. The above were distributed as *Ingenhouzia triloba* DC.
Hibiscus Coulteri Harv. ex Gray—621 G, S; 3091 a; 3318 G; 3318-a; 3747 G, M, S; 4584; 4665.
Hibiscus denudatus Benth. var. *involucellatus* Gray—682; 3069 G, M, S; 4557; 4574.
Kosteletskyia Thurberi Gray—Limpiatuna. 2770 M.
Malvastrum coromandelianum (L.) Garke—3591 G, M, S.
Pseudabutilon Sonorae Wiggins—3586 G, M, S.
Sida angustifolia Lam.—3561 G, M, S; 3599 G, M, S.
Sida hastata St. Hil.—3858 M.
Sida hederacea Torr.—635 S; 1108 G, S.
Sida lepidota Gray—2613 C, G, M, S.
Sida neomexicana Gray—2563 G, M, S; 2566 C, G, M, S; 3996.
Sida procumbens Sw.—474-P; 859-P; 2858; 2944 G, M; 2975 G, M, S; 3045 G, S; 3109; 3264 G, S; 3600 G, M, S; 4477; 4500; 4711 M.
Sida tragiaefolia Gray—3560 G.
Sida sp.—3857.
Sphaeralcea angustifolia (Cav.) Don—4888.
Sphaeralcea exilis (Gray) Jepson—4439.
Sphaeralcea Fendleri Gray—333-P; 559-P; 743 ? ; 1116 S; 2510 G, M, S; 3346 G, M, S; 4279; 4376; 4620 M.
Sphaeralcea Fendleri var. *albescens* Kearney—558-P.
Sphaeralcea hastulata Gray—2571 G.
Sphaeralcea laxa Woot. & Standley—3325 G, M; 3581 G, M, S; 4129; 4686.
Sphaeralcea sp.—627; 3070; 3088.

Bombacaceae

- Ceiba acuminata* (Wats.) Rose—Pochote. 385 G, M, S; 2911 G.

Sterculiaceae

- Ayenia pusilla* L.—3084 M, S; 3238 G, M, S; 3589 G, M, S; 4026; 4481; 4501 M; 4518.
Waltheria americana L.—2908; 3014 G, M, S; 3582 C, G, M, S; 4029 G, M, S; 4150 C, G, M, S.

Fouquieriaceae

- Fouquieria Macdougalii* Nash—Ocotillo. 398 G, S; 3535.
Fouquieria splendens Engelm.—Ocotillo, ocotillo del corral. 405 G, S.

Cistaceae

- Helianthemum majus* (L.) B. S. P.—3434 C, G, M, S; 3513 C, G, M, S; 4262; 4406.

Cochlospermaceae

- Amoreuxia palmatifida* M. & S.—Saya, témaqui. 630 C, S; 2668 G, M, S; 2953 G, M, S; 3041; 3079 G; 3969 M, S.

Koeberliniaceae

- Koeberlinia spinosa* Zucc.—4586.

Passifloraceae

- Passiflora bryonioides* H, B, K.—466-P; 760-P; 2638 G, M, S; 3073 G, M, S; 3392 G, M, S; 4043 S.
Passiflora foetida L.—521-P; 3576; 3607 G, M, S.
Passiflora mexicana Juss.—3806 G, M, S; 4490 M, S.

Loasaceae

- Mentzelia asperula* Woot & Standley—2675 C, G, M, S; 3773.
Mentzelia hispida Willd.—2718 C, G, M, S; 4553 ?
Mentzelia multiflora (Nutt.) Gray—Hierba pegajosa. 844-P; 323 G, S; 422 G, S; 1103 G, S; 2518 G, M, S; 2872 G, M, S; 2980 G, M, S; 4125; 4452a.
Mentzelia sp.—4654.

Begoniaceae

Begonia Martiana Link & Otto—Cañaira. 552-P; 641-P; 2720 G, M, S; 3286; 3387 G, S; 4286 C, G, M, S; 4838.

Cactaceae

Cereus Greggii Engelm.—4537.

Echinocereus rigidissimus (Engelm.) Rose—1608-H; 792-P; 4280; 4506; 4874.

Echinocereus Virickii—562-P.

Opuntia arbuscula Engelm.—Collection number lost.

Opuntia hystricina Engelm. & Bigel.—3829.

Opuntia imbricata (Haworth) DC.—313-P.

Opuntia Kleiniae DC.—317-P.

Opuntia leptocaulis DC.—Collection data lost.

Opuntia Lindheimeri Engelm.—305-P; 344-P; 370-P.

Besides the above, several mammillarias were collected which have not been identified. *Opuntia Engelmannia*, *O. Loomisii*, *O. versicolor* and *O. fulgida* were not collected but were identified from photographs by Dr. E. U. Clover.

Lythraceae

Cuphea Wrightii Gray—464-P; 2538; 2674 C, G, M, S; 3319 G, M, S; 3365 G, S; 3694; 3777; 4090 C, G, M, S; 4330 G, M, S.

Lythrum californicum Torr. & Gray—328-P; 703 G, S; 975. The above were distributed as *L. linearifolium* (Gray) Small.

Onagraceae

Epilobium Halleianum Hausskn.—700; 977; 3511 G, M, S. Distributed as *E. Drummondii* Hausskn.

Gaura coccinea Nutt.—405-P; 2572 G, M, S; 3442 G, M, S.

Gaura coccinea var. *epilobioides* (H. B. K.) Munz—1105 G, S.

Gaura gracilis Woot. & Standley—417-P.

Gaura parviflora Dougl. var. *lachnocarpa* Weatherby—Hierba salada. 299 G, S; 436 G, S; 777 S; 2902 G, M, S; 2958 G, S; 3808 G, M, S; 4419 M.

Lopezia gracilis Wats.—4314; 4779.

Oenothera albicaulis Nutt.—3856 ?

Oenothera caespitosa Nutt. var.—571 S; 1117; 2577 C, G, M, S.

Oenothera Greggii Gray—3190 C, G, M, S.

Oenothera Hartwegii Benth. var. *Toumeyii* (Small) Munz—993 G, S; 2842; 3446 G, M, S.

Oenothera Hookeri Torr. & Gray var. *irrigua* (Woot. & Standley) Gates—332-P; 744 G, S; 3186 C, G, M, S; 3324 C, G, M, S; 3361 C, G, M, S; 4187 M, S.

Oenothera laciniata Hill—3441.

Oenothera rosea Ait.—326-P; 304 G, S; 578; 667; 2898 G, M, S; 2988 G, M, S; 3385 G, M, S.

Oenothera speciosa Nutt.—595; 2949; 3252; 3443; 3524; 3711; 4052.

Zauschneria arizonica Davidson—2533 G, M, S; 3038 G, S; 3307 G, M, S; 4092; 4274 S; 4666 M, S.

Araliaceae

Aralia humilis Cav.—Palo santo. 709-P; 2728 C, G, M, S; 2760 G, M, S; 2777 G, M, S.

Aralia pubescens DC.—4672 C, G, M, S.

Aralia racemosa L.—3282 M, S.

Umbelliferae

Eryngium Lemmoni Coult. & Rose—3429 G, M, S.

Eryngium heterophyllum Engelm.—2659; 3700 G, M, S; 3724 G; 4070.

Foeniculum vulgare Hill—Hinojo. 300.

Prionosciadium Watsoni C. & R.—Hierba del oso. 2661 G, M, S; 3219 G, M, S; 3305 G, M, S; 3673 G, M, S.

Ericaceae

Arbutus arizonica (Gray) Sarg.—Madroño. 2714 G, M, S; 2830 G, M, S; 3152 G, M, S; 3391 G, M, S; 3925 C, G, M, S; 4802.

Arctostaphylos pungens H. B. K.—Manzanita. 634-P; 513 G, S; 2652 C, G, M, S; 2744 G, M, S; 2818 G, M, S; 3177 G, M, S; 3232 G, M, S; 3946 C, G, M, S; 4267 G, S.

Chimaphila maculata (L.) Pursh—3444 G; 4832 G, M, S.

Pterospora Andromedae Nutt.—4824.

Primulaceae

Anagallis arvensis L.—305 G, S.

Samolus floribundus H. B. K.—409 S; 713; 770 G, S.

Plumbaginaceae

Plumbago scandens L.—692 G, S; 2852 G; 2912; 3266 G, M; 3534 G, M, S; 3899.

Sapotaceae

Bumelia occidentalis Hemsl.—Bebelama. 416 G, S; 3539 G, M, S.

Bumelia rigida (Gray) Small—Huajuco. 503.

Oleaceae

Fraxinus Greggii Gray—736-P; 3880 M; 4674 M.

Fraxinus Standleyi Rehder—Fresno. 3209 G, M, S.

Fraxinus Standleyi var. *lasia* Rehder—Fresno. 3421 G, M, S.

Fraxinus velutina Torr.—Fresno. 594 G, S; 2803 G, M, S; 2966 G, M, S; 3529 G, M, S; 4083 M; 3273; 4414 M.

Fraxinus velutina var. *glabra* Rehder—Fresno. 690 G, S; 2899 G, M, S.

Fraxinus velutina var. *Toumeyii* Rehd.—3096 G, M, S.

Fraxinus sp.—3989 M; 4196.

Menodora scabra Gray—4576 M; 4886.

Loganiaceae

Buddleia Wrightii Robins.—Tapiro. 295.

Gentianaceae

Centaurium venustum (Buckl.) Robins.—674; 767. The above were distributed as *Erythraea calycosa* Buckl.

Eustoma exaltatum (L.) Griseb.—415 G, M, S.

Gentiana microcalyx Lemmon ex Engelm.—4771 M.

Halenia recurva (Smith) Allen—648-P; 3462. The above were distributed as

Halenia Rothrockii Gray.

Apocynaceae

Amsonia pogonosepala Woods.—3021 G, M, S; 3861 M.

Apocynum androsaemifolium L.—671-P; 576.

Haplophyton cimicifidum A. DC.—Hierba del piojo. 473-P; 485; 536 G, S; 738; 3023 G, M, S; 3572 G, M, S; 3796 G, M, S; 4498 G, M, S; 4521; 4624 G, C, M, S.

Mandevilla foliosa (Muell. Arg.) Hemsl.—Hierba del piojo. 481-P; 588 G, S; 2752 G, M, S; 3107 G, M, S; 3267 G, M.

Stemmadenia tomentosa Greenm. var. *Palmeri* (Rose) Woods.—Zapote. 2927 G, S.

Asclepiadaceae

Asclepias galioides H. B. K.—463-P; 479-P; 1039 G, S; 2590 C, G, M, S; 3114 G, M, S; 3364 G, S.

Asclepias glaucescens H. B. K.—Oreja de mula. 2603 G, M, S; 2654 G; 3117 G, M, S; 3260 G, M; 3984.

Asclepias hypoleuca (Gray) Woods.—Oreja de mula. 2847 G, M, S; 3156 G; 3428.

Asclepias Linaria L.—2766 G, M, S; 3059 G, M, S; 3928 M.

Asclepias mexicana Cav.—505 S; 563; 619.

Asclepias tuberosa L.—610 G, S; 3440 G, M, S; 3676 G.

Gonolobus productus Torr.—529-P; 752-P; 617 S; 2822 G; 3257 G, M, S; 3776 G, M, S.

Marsdenia edulis Wats.—615 G, S; 2915 G, M, S.

Matelea tristiflorum (Standley) Woods.—470-P; 3005; 3293 G, M, S. In the above specimens the flowers are somewhat smaller than described.

Metastelma angustifolium Turcz.—540-P; 523; 4377 M.

Metastelma Watsonianum Standley—530-P; 591 G, S; 3239 G, S; 3602 G, S.

Sarcostemma crispum Benth.—Hierba del indio. 2810.

Sarcostemma cynanchoides Decne.—3720 G, M, S.
Sarcostemma heterophyllum Engelm.—354 G, S; 425 G, S; 727 G, S; 3719 G, M, S;
 4462 M.

Convolvulaceae

Convolvulus incanus Vahl—2528 G, M, S.
Cuscuta odontolepis Engelm. var. *typica* Yuncck.—2730 G, M.
Evolvulus alsinoides L.—538; 3332 G, M, S; 3593 G; 3704 G, M, S; 4034 C, G, M, S;
 3499 C, G, M, S; 4862.
Evolvulus arizonicus Gray—611 G, S; 616; 2531 G, M, S; 2656 G; 2657 G; 3028 G,
 M, S; 3784; 3970 G, M, S.
Evolvulus sericeus Sw.—956; 2835.
Ipomoea ancisa House—Baburia. 917 G, S; 2552 G, M, S; 2578 C, G, M, S; 2598
 C, G, M, S; 2691 G, M, S; 2692 G, M, S; 3672.
Ipomoea arborescens (H. B. K.) Don—Palo blanco. 2923 G, S.
Ipomoea barbatisepala Gray—4855.
Ipomoea costellata Torr.—545-P; 746 S; 761 G, S; 2534 G, M, S; 2671 G, M, S; 3300,
 4432.
Ipomoea desertorum House—Trompillo. 3328; 4110 C, G, M, S; 4367 G, M, S;
 4424 M; 4425 G, M, S; 4461 M.
Ipomoea Gentryi Standley—4159 G, S.
Ipomoea hirsutula Jacq.—Teompillo. 1112 G, S; 2550 C, G, M, S; 2606 G, M, S;
 2669 C, G, M, S; 3463 G; 3528; 3733; 3734; 4853.
Ipomoea Lemmoni Gray—3473 G, M, S.
Ipomoea leptotoma Gray—4031; 4560 G, S; 4619 C, G, M, S; 4851 ? ; 4854.
Ipomoea longifolia Benth.—3601 G.
Ipomoea muricata Cav.—4059.
Ipomoea patens (Gray) House—632-P.
Ipomoea sp.—4765.
Jacquemontia Pringlei Gray—3550 G; 4038.
Quamoclit coccinea (L.) Moench.—821-P; 2536 G, M, S; 4234-a; 4539 M; 4687.
Quamoclit coccinea var. *hederifolia* (L.) House—Trompillo. 965; 2535 C, G, M, S;
 2670 G, M, S; 3780 G; 4081; 4156 C, G, M, S; 4234; 4587-a.

Polemoniaceae

Gilia formosissima (Greene) Woot. & Standley—3216; 3380 G; 3487 G, M.
Gilia longiflora (Torr.) Don—637; 4484.
Gilia Macombii Torr. ex Gray—2597 ?
Gilia Pringlei Gray—973; 2520 G, M, S; 2739 G, M, S; 3433 G; 3447 M, S; 3933; 4177
 G, S; 4260 G, M, S; 4444 G, M, S; 4637 G, M, S.
Loeselia glandulosa (Cav.) Don—4669 M.
Polemonium pauciflorum Wats.—3288 G, M, S.

Hydrophyllaceae

Nama hispidum Gray—444 G, S; 445 S; 461; 699; 2897 C, G, M, S; 2940 G, M, S.
Nama undulatum H, B, K.—324 G, S.
Nama sp.—636.
Phacelia heterophylla Pursh var. *sonorensis* White—4641 M.
Phacelia platycarpa (Cav.) Spreng.—3279; 3454.

Borraginaceae

Coldenia canescens DC.—3852 M; 4582 M.
Lithospermum cobrense Greene—407-P; 2575 C, G, M, S; 2791.
Lithospermum multiflorum Torr.—3158 C, G, M, S.
Macromeria Thurberi (Gray) Mackenzie—673-P; 3155 G, M, S; 4275.

Verbenaceae

Bouchea prismatica (Jacq.) Kuntze var. *brevirostris* Grenz—2605; 2634 C, G, M, S;
 3728 G; 4055.
Lantana macropoda Torr.—4564 M.
Lippia lycioides Steud.—741 G, S.
Lippia nodiflora Michx.—411 G, S.
Lippia Wrightii Gray—3891 M; 4467 M; 4561 M; 4588 M; 4733 M.
Priva mexicana (L.) Pers.—2635 C, G, M, S.

- Verbena ambrosiifolia* Rydb. forma *eglandulosa* Perry—3929 M.
Verbena bipinnatifida Nutt. var. *latilobata* Perry—2543 G, S; 3131 G, M, S; 3261 G, M; 3731.
Verbena carolina L.—2647; 2989 G, S; 3309; 3379 G, M, S; 3715 G, M, S; 4104.
Verbena ciliata Benth.—569 S; 708 G, S; 774 G, S; 2836 G, M, S; 3085 G, M, S; 3344 G, M, S; 3787; 4178.
Verbena Ehrenbergiana Schauer—329-P; 3790 G, M, S.
Verbena elegans H. B. K. var. *asperata* Perry—3964.
Verbena gracilis Desf.—947 ?
Verbena neomexicana (Gray) Small—2787 G, M, S; 3836 M; 3882 M.
Verbena neomexicana var. *hirtella* Perry—3836a.
Verbena neomexicana var. *xylopoda* Perry—3985 M; 4176.
Verbena xutha Lehm. 753-P; 3099 G, M, S.
Verbena spp.—654; 2938 G, M, S; 3310.

Labiatae

- Agastache Barberi* (Robins.) Epling—415-P; 2722 G; 4194; 4306 M.
Agastache cana (Hook.) Woot. & Standley—3486 G, M, S; 4391. This species has a licorice odor when fresh.
Hedeoma Drummondii Benth.—2532 G, M; 3245; 3470 G, M, S.
Hedeoma oblongifolium Heller—955 G, S; 2684 G, S; 3160 G, M, S; 3706 G; 3937; 4269; 4638 M.
Hyptis albidia Kunth—2778 G, M, S.
Hyptis Seemannii Gray var. *stenophylla* Robins. 2780 G, M, S.
Marrubium vulgare L.—Marrubia. 2984 G; 3644 G, M, S; 4355 M; 4617 M.
Mentha spicata L.—461-P; 804-P; 3123 G, S.
Mentha sylvestris L.—2936 G, M, S.
Monarda austromontana Epling—Orégano. 940 G, S; 2589; 2751 G, S; 3341 G, M, S; 4068; 4243 M.
Salvia microphylla H. B. K.—3203 G, S; 3210 G, M, S; 3475 G, M, S; 4772.
Salvia Parryi Gray—3619 G, M, S; 3895 M; 3968 M.
Salvia pinguifolia (Fern.) Woot. & Standley—2717 C, G, M, S; 4379 M; 4652 M.
Salvia Seemannii Fern.—330-P; 3302 G, M.
Salvia subincisa Benth.—2768 G, M, S; 3909 M.
Salvia tiliaefolia Vahl—3145 ? G, M, S; 3457, G, M, S.
Salvia Townsendii Fern.—836-P; 2633 G, M, S; 3357 G; 3691 G, M, S.
Scutellaria resinosa Totr.—462-P; 3102 G, M, S.
Stachys coccinea Jacq.—2604 G, M, S; 2723; 3674; 3910 M; 4650 M; 4697.
Trichostema arizonicum Gray—656-P; 866-P; 962 G, S; 3221; 3373 G, M, S; 3549 G, M, S; 4212 M.

Solanaceae

- Capsicum baccatum* L.—2920 G, S; 3640 G, M, S.
Chamaesaracha coronopus (Dunal) Gray—4547 M.
Datura meteloides DC.—Toloache. 430 G, M, S; 763 G, M, S; 1089 G, M, S; 2962 G, M, S; 3526; 3735 G, S; 4458.
Datura quercifolia H. B. K.—Tokache. 433; 3395 G, M, S; 3730 G, M, S; 4454 C, G, M, S; 4457.
Lycium Andersonii Gray—4143 M.
Lycium Berlandieri Dunal—4527.
Lycium Torreyi Gray—4496 M.
Lycopersicum esculentum Mill.—Tomate. 768 G, S. (volunteer on site of an abandoned army garrison).
Nicotiana glauca Graham—Alamo loca, palo loco. 826-P; 293 G, M, S; 427 G, S; 2947 G, M, S; 3378 G, M, S; 3536 G, M, S; 4139 C, G, M, S; 4440 G, M, S.
Nicotiana trigonophylla Dunal—Tabaco de coyote. 476-P; 232 G, S; 454; 652 S; 2918 G, M, S; 3032 G, M, S; 3772; 3849 C, G, M, S; 4445.
Petunia parviflora Juss.—307 S; 658.
Physalis crassifolia Benth.—4018.
Physalis hederifolia Gray—Rama de amores. 580 G, S; 3224 G, M, S; 4693.
Physalis ixocarpa Brot.—Tomatillo, tomatito. 677; 637; 2888 M, S.
Physalis lanceolata Michx.—3285 G, M, S; 3431 M, S.
Physalis pubescens L.—672; 2846; 3207; G, M, S.
Physalis Wrightii Gray—Tomatillo cimarrón. 758 G, S; 2576 G, M, S; 3714; 4134 C, G, M, S.

- Saracha procumbens* (Cav.) R. & P.—Tulusisi. 2682; 2982 G, S.
Solanum deflexum Greenm.—2672; 3334.
Solanum elaeagnifolium Cav.—Tomatito, tomatito de buena mujer. 439 G, S; 2526 G, M, S; 2574 C, G, M, S; 2870; 3822 G, M, S; 3879 G, M, S; 4133 C, G, M, S.
Solanum Jamesii Torr.—2501 G, M, S.
Solanum nigrum L.—Chichiquelite. 442 G, S; 669 G, M, S; 2636 G, M, S; 2878 G, M, S; 2937 G, M, S; 2952 G, M, S; 3291 G, M, S; 3383 G, M, S; 3725 G, M, S; 3930; 4069 C, G, M, S; 4462 C, G, M, S.
Solanum tuberosum L. var. *boreale* Gray—3284 H; 3498.

Scrophulariaceae

- Bacopa procumbens* (Mill.) Greenm.—644; 656; 717 C, G, S; 779 S; 1001 S; 2933 G; 2955; 3030; 3323 G, S; 3597 G, M, S; 3788 G, S. All of the above, except 656 and 3788, were distributed as *Mecardonia procumbens* (Mill.) Small.
Buchnera pusilla H. B. K.—3331 G, S.
Castilleja angustifolia (Nutt.) Don—2762; 3091.
Castilleja integra Gray—1000.
Castilleja lanata Gray—629 S; 3067.
Castilleja laxa Gray—3905; 4080 M, S; 4398 M; 4783.
Castilleja lithospermoides H. B. K.—567; 3945.
Castilleja patriotica Fern.—3355 G, M, S.
Castilleja tenuiflora Benth.—3135 G, S; 3548 G, M, S.
Conobea intermedia Gray—2693 C, G, M, S; 4402.
Gerardia Wrightii Gray—412-P; 2704 C, G, M, S; 3579 M, S; 4203.
Lamourouxia viscosa H. B. K.—2715 G, S.
Limosella aquatica L.—460.
Maurandia antirrhiniflora H. & B. ex Willd.—740 G, S; 4422 M.
Mimulus cardinalis Dougl.—465-P; 684 G, S.
Mimulus glabratus H. B. K.—2950 G, M, S.
Mimulus guttatus DC.—456 S.
Mimulus nasutus Greene—341 G, S; 2917 G, S.
Mimulus pallens Greene—4841 M. This specimen scarcely agrees with Grant's treatment of the species (15a), being glandular-pubescent rather than glabrous, but it appears to be identical with one or two collections annotated by her in the U. S. National Herbarium.
Pentstemon barbatus (Cav.) Nutt.—3352; 4304.
Pentstemon campanulatus (Cav.) Willd.—413-P; 3306 C, G, M, S; 3677 C, G, S. The above were distributed as *P. pulchellus* Lindl.
Pentstemon campanulatus var. *subglandulosus* White—2645 G, M, S.
Pentstemon Parryi Gray—3699.
Pentstemon secundiflorus Benth.—2948 G, M, S.
Pentstemon Torreyi Benth.—972; 2841 G, M, S; 3141 C, G, M, S; 3448 G; 4770.
Pentstemon sp.—4807.
Seymeria bipinnatifida Seem.—414-P; 3403 G, M, S.
Stemodia durantifolia (L.) Sw.—657 G, S; 2913 G, M, S; 3031 G; 3789 G, M, S.
Veronica peregrina L.—342.

Bignoniaceae

- Chilopsis linearis* (Cav.) Sweet—737 G, S; 1090 G, S; 2617 G, M; 3833 C, G, M, S; 4123 G, S; 4540.
Tecoma incisa (Rose & Standley) Johnston—Caballito. 468-P; 537 G, M, S; 2779 G, M, S; 2926 G, M, S; 3004 G, M, S; 3617 G; 3957 C, M, S.

Martyniaceae

- Martynia alihaefolia* Benth.—407 G, S; 3850 C, G, M, S; 4555.
Martynia fragrans Lindl.—Gatito, gatúño. 451 S; 2905; 3683 S; 4077; 3359 M.

Acanthaceae

- Anisacanthus insignis* Gray—4845.
Dicliptera resupinata Juss.—2886 G, M, S.
Dyschoriste decumbens (Gray) Kuntze—2696; 3705 G; 3761 G, M, S; 4060.
Elytraria imbricata (Vahl) Pers.—Cordoncillo. 2649 G, M, S; 2772 G, S.
Elytraria squamosa (Jacq.) Lindau—Cordoncillo. 491; 540.
Jacobinia candicans (Nees) Benth. & Hook.—755-P.

Ruellia nudiflora (Engelm. & Gray) Urban var. *glabrata* Leonard—Cuetito. 759 G, S; 3565 G, M, S; 3809; (distributed as *Rueilla tuberosa* L. var. *occidentalis* Gray); 4111.

Siphonoglossa longiflora Gray—3590 G; 4622.

Tetramerium hispidum Nees—761-P; 837-P; 852-P; 2773 G, M, S; 3333 G, M, S; 3612; 3727 G, M, S; 4455 M; 4470 M; 4632 M.

Plantaginaceae

Plantago major L.—325-P.

Rubiaceae

Bouvardia glaberrima Engelm.—Chicoria, mirto. 509 S; 2653 G, S; 2716 C, G, M, S; 2806; 3024 G, S; 3057 G, S; 3092 G; 3170 G, M, S; 3384; 3793; 3974 M, S; 4224 M, S; 4703 M.

Crusea brachyphylla Cham. & Schlecht.—4272 ?

Crusea hispida (Mill.) Robins—2618 C, G, M, S.

Diodia teres Walt. var. *angustata* Gray—4385 M; 4780.

Galium asperum Gray—4192 C, S.

Galium mexicanum H, B, K.—2709 G, M, S.

Galium microphyllum Gray—964 S; 4171; 4751 M.

Galium Rothrockii Gray—3204 G, M, S; 4319 M; 4320 M; 4643 M.

Houstonia angustifolia Michx. var. *rigidiuscula* Gray—3108.

Houstonia rubra Cav.—3327 G, M, S.

Houstonia Wrightii Gray—592; 967; 2608.

Randia Watsoni Robins.—Papache. 2782; 3630.

Caprifoliaceae

Lonicera arizonica Rehd.—3281 C, M, S; 4801.

Lonicera cerviculata White—2832 G, M, S; 3422 G, M, S, (distributed as *L. sullivantii* Gray); 3934 M; 4195; 4277 M.

Sambucus caerulea Raf.—Sauco. 660 G, S; 4133.

Sambucus mexicana Presl—Sauco. 504-P; 2972 G, M, S.

Valerianaceae

Valeriana sorbifolia H, B, K.—4781.

Cucurbitaceae

Apodanthera undulata Gray—Melón de coyote. 631 S; 919 G, M, S; 3781 G, M, S 3827.

Citrullus vulgaris Schrad.—Sandía. 772.

Cucurbita digitata Gray—Calabacilla, chichicayota. 450; 4570 C, G, M, S.

Cucurbita foetidissima Gray—3810; 3828; 4127 C, G, M, S.

Cyclanthera dissecta (Torr. & Gray) Arn.—2754 G, S.

Echinopepon Wrightii (Gray) Wats. 754-P; 4036 M, S; 4449 C, M; 4463.

Iberivillea tenuisecta (Gray) Small—3680.

Sicyosperma gracile Gray—3723 G, M, S.

Lobeliaceae

Lobelia cardinalis L.—628-P; 669-P; 702 G, M, S.

Lobelia fenestralis Cav.—707.

Lobelia laxiflora H. B. K.—343 G, S; 3113 G, M, S.

Compositae

Ageratum corymbosum Zucc.—3010 G, M, S; 3222 G; 3247 G, S; 3501 G, S; 3558 G, S; 3584 G, M, S; 3897.

Ambrosia aptera DC.—Chuchuni. 3739 G, M, S; 4115 C, G, S.

Ambrosia psilostachya DC.—861-P; 2700 C, G, M, S.

Arctium Lappa L.—4460.

Artemisia gnaphalodes Nutt.—4001 M; 4450 M.

Artemisia ludoviciana Nutt.—2703 G, M, S; 4392; 4830.

Aspilia stenophylla Greenm.—2663 G, M, S.

Aster canescens Pursh var. *latifolius* Gray—2903.

Aster exilis Ell.—827-P; 712; 750 G, S; 2981 G; 3110 G, M, S; 3420 G, M, S; 2687 G, M, S; 3971 M; 4170; 4750.

- Aster Leucelene* Blake, var.—2559 G.
Aster potosinus Gray—3125 G, M, S.
Aster spinosus Benth.—4541 C, G, M, S.
Aster tagetinus (Greene) Blake—764-P; 814-P.
Aster tanacetifolius H. B. K.—4124 C, G, M, S.
Baccharis glutinosa Pers.—Batamote, jarilla. 675 G, S; 2601 C, G, M, S; 3276 G, M, S; 3531 G, M, S; 3745 G, M, S; 3843 G, M, S; 3987 C, G, M, S; 4140 C, G, M, S; 4749.
Baccharis sarothroides Gray—Romerillo. 4611; 4867.
Baccharis thesioides H. B. K.—Hierba del aire. 787; G, S; 974 G, S.
Bahia dissecta (Gray) Britton—429-P; 3349 G, M, S; 3416 G, M, S; 4191; 4300 C, G, M, S. These specimens were distributed as *C. chrysanthemoides* Gray.
Bahia oppositifolia (Nutt.) DC.—4885.
Baileya Thurberi Rydb.—3823; 3903 C, G, M, S.
Bebbia juncea Greene—745 S; 786 S; 3577 M, S.
Bellis mexicana Gray var.—3692 G, M, S.
Berlandiera lyrata Benth.—Hierba de la víbora. 596; 3708; 3821 G, M, S.
Bidens anthriscoides DC.—Saetilla. 2643; 3652 G, M, S.
Bidens Bigelovii Gray—3610 G, M, S.
Bidens Gentryi Sherff—3374 C, G, M, S; 4411 ? M.
Bidens heterosperma Gray—4299 M.
Bidens leptocepala Sherff—2522 G, M, S; 4775.
Bidens pilosa L.—Saetilla. 853-P; 2641 G, M, S; 2984 G, M, S; 3559; 3721 G, S; 3980 M; 4326 M; 4616 M; 4694 M.
Brickellia californica (Torr. & Gray) Gray—4642.
Brickellia Coulteri Gray—4567 M.
Brickellia grandiflora (Hook.) Nutt. var. *petiolaris* Gray—4408 G, M, S.
Brickellia simplex Gray—3693 G, M, S.
Brickellia venosa (Woot. & Standley) Robins—4516 M.
Cacalia decomposita Gray—Matarique. 651-P; 2741 G, M, S; 3289 G, M; 4353.
Centaurea americana Nutt.—3347 G, M, S.
Chrysopsis villosa (Pursh) Nutt.—3493 G, S; 4388 C, G, M, S.
Cirsium arizonicum (Gray) Petrak—Cardo santo. 600; 2573 G, S; 2711 G, S; 2849 G; 2976; 3161 G, M, S; 3449 G, M, S; 4311; 4739.
Conyza sophiaefolia H. B. K.—4169.
Coreocarpus arizonicus (Gray) Blake var. *pubescens* (Robins. & Fern.) Blake—542-P; 697; 4668 M; 4752. 542-P was distributed as *Leptosyne arizonica* Gray var. *pubescens* Robins. & Fern., and 697 as *C. arizonicus* (Gray) Blake.
Cosmos crithmifolius (Jacq.) H. B. K.—Bavisa, tostón. 631-P; 3153; 3206 G, M, S; 3455 G; 3456 G, M, S.
Cosmos parviflorus (Jacq.) H. B. K.—Tostón. 2701 C, G, M, S; 3394 G, M, S; 4183 C, G, S; 4763.
Dyssodia anomala Robins.—3321 G, M, S; 3627 G, M, S.
Eclipta alba (L.) Hassk.—650 G, S.
Encelia farinosa Gray—Chamiso. 3573 G, S; 4880.
Encelia subaristata Gray—3120 G, S; 3292 G, M, S; 4155 G, S.
Erigeron Bellidiastrum Nutt.—4076; 4078.
Erigeron canadensis L.—698 G, S; 749 S; 3359 G, M, S; 3492 H, M, S; 3737 G, M, S.
Erigeron concinnus (Hook. & Arn.) Torr.—480-P.
Erigeron delphinifolius Willd.—3477 G, S; 3490 G.
Erigeron divergens Torr. & Gray—2665 G; 4246.
Erigeron filifolius Nutt.—705 G, S.
Erigeron flagellaris Gray—597; 2560.
Erigeron neomexicanus Gray—992; 3137; 3628 G, S; 4410 M; 4709.
Erigeron philadelphicus L.—3507 M, S.
Erigeron quercifolius Lam.—2721.
Erigeron sp.—2896 G, N, S, US.
Eupatorium coelestinum L.—2631 C, G, M, S.
Eupatorium grandidentatus DC.—4407.
Eupatorium Greggii Gray—3854 C, G, M, S.
Eupatorium Lemmoni Robins.—4373 M.
Eupatorium pycnocephalum Less.—4670 M.
Eupatorium Rothrockii Gray—4804 M.
Eupatorium solidaginifolium Gray—4438 M.

- Flaveria trinervia* (Spreng.) C. Mohr.—3842.
Franseria ambrosioides Cav.—Chicuri. 4022 G, M, S; 4534 C, G, M, S.
Franseria tenuifolia Gray—4020 G, M, S; 4427 C, G, M, S; 4604 G, M, S.
Gaillardia pinnatifida Torr.—2524 G, M, S.
Galinsoga parviflora Cav.—948 S; 2500 G, M, S; 3401 G, M, S.
Gnaphalium chilense Spreng.—719 G, S; 2963 G, M, S; 4245 G, S.
Gnaphalium leptophyllum DC.—4245-a.
Gnaphalium Wrightii Gray—3595 G, M; 4649 G, M, S; 4717 G, M, S.
Guardiola platyphylla Gray—620 G, S; 2683 C, G, M, S; 3022 G, M, S; 3256 G, M, S; 3533 G, M, S; 3906 C, G, M, S.
Gutierrezia lucida Greene—4465 G, S; 4526 G, M, S; 4593 C, G, M, S; 4706 G, M, S.
Gutierrezia microcephala (DC.) Gray—4132 G, S; 4546 M.
Gutierrezia Sarothrae (Pursh) Britt. & Rusby—3840 C, G, M, S.
Haplopappus gracilis Gray—858-P; 2506 G, M, S; 2699 C, G, M, S; 3684; 3173 G, S.
Haplopappus laricifolius Gray—4635 C, G, M, S.
Haplopappus spinulosus (Pursh) DC.—756 G, S; 3847 C, G, M, S; 3873.
Helenium Thurberi Gray—778; 2891 M, S; 2914 G, M, S; 2945; 3043 G, M, S; 3115; 3782 G, M, S.
Helianthus annuus L.—Girasol. 448 S; 2874 G, M, S; 2956 G, M, S; 3718 G, S; 4116 C, G, S.
Heliopsis parvifolia Gray—423-P; 3072 G, M; 3104 G, M, S; 3121 G, M, S; 3154 G, M, S; 3214 G, M, S; 3259 G, M, S; 3368 G, M, S; 3939 G, M, S; 4289 C, G, M, S; 4291 M; 4389 M; 4647 G, M, S.
Heliopsis sp.—2839 G.
Heterospermum pinnatum Cav.—2702 C, G, M, S; 4299-a; 4775-b.
Heterotheca subaxillaris (Lam.) Britt. & Rusby—2906; 4418 C, G, M, S.
Hieracium Fendleri Sch. Bip.—Tinhuinahua, tininahua. 593; 2734 C, G, M; 3315; 3418.
Hieracium Lemmoni Gray—3211 G, S.
Hymenoclea monogyra Torr. & Gray—Jécota. 4538 G, M, S; 4866 G, S.
Hymenothrix Wislizeni Gray—2505 G, M, S; 2792 G, M, S; 3701 G, S; 4417 G, M, S.
Hymenothrix Wrightii Gray—3778; 4248 C, G, M, S; 4753 M.
Iva ambrosiaefolia Gray—4544.
Kuhnia oreithales Robins.—2581 G, M, S.
Kuhnia rosmarinifolia Vent.—4366 M.
Lactuca graminifolia Michx.—3482 G, S.
Lactuca pulchella DC.—3251 G.
Lactuca scariola L. f. *integrifolia* Bogenhard—4310.
Lagascea decipiens Hemsl.—3097 G; 3624 G, M, S; 3797 G, M, S. These were distributed as *Nocca decipiens* (Hemsl.) Kuntze.
Laphamia Palmeri Gray?—3015.
Malacothrix saxatilis Torr. & Gray—4368; 4787.
Melampodium appendiculatum Robins.—2784 G, M, S; 3516 G, M, S; 3779; 3908 G, M, S; 4153 C, G, S.
Melampodium cinereum DC.—839-P; 4513 C, G, M, S; 4587 G, M, S.
Melampodium hispidum H. B. K.—2642 C, G, S; 2788 G, M, S.
Melampodium longicornu Gray—4073.
Milleria quinqueflora L.—824-P; 3675 G, M, S.
Parthenice mollis Gray—2711 G, M, S; 3786 G, M, S; 4164 C, G, M, S.
Pathenium incanum H. B. K.—2855 G, M, S; 3838 C, G, M, S; 4530 G, M, S; 4594 G, M, S.
Parthenium Stramonium Greene—Guasaraco. 393 G, S; 2922 G, M, S.
Pectis filipes Gray—848-P; 1094 S; 2694 G, S; 3688; 4577.
Pectis imberbis Gray—856-P; 3337 G, S.
Pectis linifolia L.—4456 M.
Pectis longipes Gray—3689.
Pectis prostrata Cav.—815-P; 1096; 1101 G, S; 2644; 3698 G, M, S; 3995; 4165 C, G, M, S.
Perezia nana Gray—3876.
Perezia Thurberi Gray—2776 G, M, S; 4517.
Perityle microcephala Gray—4852.
Perityle microglossa Benth.—Manzanilla de coyote. 510-P; 3320 G, M, S.
Pinaropappus roseus Less.—2844 H; 3191 G, M, S; 3445.
Porophyllum macrocephalum DC.—Hierba del venado. 2666 C, G, M, S; 3664.

- Rudbeckia laciniata* L.—683-P.
Sanvitalia Aberti Gray—2504 G, M; 4747.
Schkuhria Wislizeni Gray—4775-a.
Schkuhria Wrightii Gray—4792.
Selloa glutinosa Spreng.—Jécota. 817-P; 2857; 3741 G, M, S; 4162 G, S; 4451 G, M, S; 4625 C, G, M, S.
Senecio Hartwegi Benth. Hoja semita. 3464; 4818.
Senecio longilobus Benth.—2750 G, M; 4416 G, M, S. (distributed as *S. filifolius* Nutt.).
Senecio Parryi Gray—3197 M.
Solidago Wrightii Gray—3450.
Sonchus asper (L.) Hill—Chinita. 412 S; 963; 2887.
Sonchus oleraceus L.—3412 G, M, S.
Stephanomeria Thurberi Gray—2529 G, M, S; 4746 ?
Stevia Palmeri Gray—3166 G, S; 3169 G, M, S; 3202 G, M, S; 4190 M.
Stevia Plummerae Gray—654-P; 3168 C, G, M, S.
Stevia Plummerae var. *alba* Gray—3167 G, M, S; 4372 C, G, M, S.
Stevia salicifolia Cav.—646-P; 3345 G, M, S; 4784 M.
Stevia viscida H. B. K.—4374 C, G, M, S.
Tagetes alamensis Rydb. var.—4735 C, G, M, S; 4833 G, M, S.
Tagetes micrantha Cav.—2747 C, G, M, S; 3479 G; 4298 G, M, S.
Tithonia Thurberi Gray—3645 G, M, S; 3717 G, M, S.
Tragoceros zinniioides H. B. K.—2628 C, G, M, S; 3515 G, M, S.
Trixis californica Kellogg—4472 G, M, S; 4646 C, G, M, S.
Trixis radialis (L.) Kuntze—Hierba del aire. 2853; 2992 G, M, S.
Verbesina enceloides (Cav.) B. & H.—426 S; 659 G, S; 2866 G, M, S; 2985; G, S; 3851; 4114 C, G, S.
Verbesina longifolia Gray—2713 C, G, M, S; 2843; 3171 G, M; 3290 G, M, S; 3471 G, M; 4249 G, M, S.
Verbesina Rothrockii Robins. & Greenm.—3871.
Viguiera annua (Jones) Blake 1003 C, G, M, S; 4655 G, M, S; 4690 G, M.
Viguiera cordifolia Gray—3426 G, M, S; 4290 G, M, S; 4371 C, G, M, S.
Viguiera dentata (Cav.) Spreng.—756-P; 4119 C, G, S; 4434 G, M, S; 4514 G, M, S.
Viguiera dentata var. *helianthoides* (H. B. K.) Blake—4691 C, G, M, S.
Viguiera dentata var. *lucifolia* Blake—3039 G, M, S; 3326 G, M, S; 4631 G, S.
Viguiera longifolia (Robins. & Greenm.) Blake—4828.
Xanthocephalum Wrightii Gray—684-P; 3410 G, M, S; 3451 G, M, S; 4247; 4261; 4834.
Zaluzania Grayana Robins. & Greenm.—4390.
Zexmenia ceanothifolia (Willd.) Sch. Bip.—2781 G, M, S.
Zexmenia podocephala Gray—Pionia. 855-P; 957 G, S; 2600 C, G, M, S; 2630 C, G, M, S; 2838; 3072-a; 3089 G; 3136; 3258 G, M, S; 3936; 4333 C, G, M, S.
Zinnia grandiflora Nutt.—2558 G, M, S; 2993; 3831.
Zinnia multiflora L.—834-P; 2629 C, G, M, S; 3100; 3369; 3663 G, M, S; 3975; 3981.
Zinnia pumila Gray—664 G, S; 3820 G, M, S; 4575 C, G, M, S.

MAP OF THE REGION OF THE RIO DE BAVISPE

The limits of the vegetational types, outside of the loop of the Bavispe River, are taken from Brand (7). In comparing Brand's vegetation map with the one presented here, only two significant differences are noted: his map gives no indication of pine land in the Sierra de El Tigre, and between Moctezuma and Guásabas he shows an "oak-agave-juniper" type where there is actually mesquite-grassland, or more precisely, a transition from desert to thorn forest as described by Shreve (44). The southern limit of the oak-grassland occupying the Nacozari highlands remains undetermined.

The numbered stations on the map may be identified by the following list:

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| 1. Western foothills of the Sierra de la Cabellera | 7. La Fiebre, Cañón de la Palomita |
| 2. Mesa de las Carreras | 8. La Matancita |
| 3. La Vega Azul | 9. Rancho de Cruz Díaz |
| 4. Agua Zarca | 10. Rancho de Ortiz |
| 5. Molino Quemado | 11. Puerto de los Aserraderos |
| 6. Rancho del Cumarito | 12. Cañón International |
| | 13. Cañón de Santa Rosa. |

INDEX TO COLLECTING STATIONS

The stations of all plants included in this paper are listed below in chronological order. The collection numbers corresponding to each station enable the reader to determine the location of any plant in the Annotated List of Species. As in that list the initials H, P and S identify the collections of Harvey, Phillips and Santos, respectively.

The elevation of each station is given where known (as determined by aneroid reading), otherwise the vegetational zone is indicated.

1938

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| 293- 307 | June 24. Río Moctezuma near Moctezuma. Lower mesquite-grassland. |
| 308- 321 | June 26. Arroyo El Sauce, Sierra de Oposura, about 16 km. east of Moctezuma. Mesquite-grassland. |
| 322- 357 | June 27-29. Río Moctezuma, near Moctezuma. |
| 358- 397 | June 30. Cajón de la Higuera, west of Moctezuma. A deep well-watered canyon in the upper mesquite-grassland. |
| 398- 406 | July 1. 8-12 km. north of Moctezuma on road to Cumpas. Mesquite-grassland. |
| 407- 417 | July 1. Near Tonibabi, east of Moctezuma. Mesquite-grassland. |
| 418- 464 | July 6-7. Colonia Oaxaca, 915 m. |
| 465- 599 | July 12-19. Cañón de Santa Rosa, 1200-1510 m. |
| 600- 610 | July 19. Cañón del Oso, a branch of the Santa Rosa. Elev. approximately 1250 m. |
| 611- 620 | July 20. Cañón de Santa Rosa, 1250 m. |
| 621- 632 | July 20. Various points between Cañón de Santa Rosa and Bavispe. Mesquite-grassland. |
| 633- 686 | July 23-30. Colonia Oaxaca and vicinity. |
| 684- 726 | July 30. Arroyo del Pulpito, 1080 m. |
| 727- 737 | July 31. Colonia Oaxaca. |
| 738- 751 | July 31. Arroyo del Pulpito. |
| 752- 755 | Aug. 1-2. Colonia Oaxaca. |
| 756- 760 | Aug. 3. Between Colonia Oaxaca and Arroyo del Pulpito, 1160 m. |
| 761- 786 | Aug. 3. Arroyo del Pulpito. |
| 787 | Aug. 5. Colonia Oaxaca. |
| 788-1140 | Aug. 14-31. Carretas, Chih., 1460 m. |

1939

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| 1590-1642-H | Aug. 26-28. Carretas, Chih. |
| 2496-2617 | |
| 1644-H | Aug. 31. Between Bacerac and Huachinera. Upper mesquite-grassland. |
| 1645-1744-H | Sept. 1-8. Huépari and vicinity. Oak-grassland. |
| 2618-2700 | Sept. 2-3. Cañón de Huépari, 1310 m. |
| 2701-2709 | Sept. 4. Cerro del Capulín, near Huépari, 1860 m. |
| 2730-2731 | Sept. 4. Cañón de Huépari. |
| 2732-2748 | Sept. 5. Cañón de Aribabi, near Huépari, 1400 m. |
| 2749-2750 | Sept. 5. Cañón de Huépari. |
| 2751-2764 | Sept. 6. Cañón de los Apaches, a branch of the Huépari. Oak-grassland. |
| 2765-2790 | Sept. 7. Puerto de Huépari, south of Huépari, 1390 m. |
| 2791-2792 | Sept. 7. Cañón de Huépari. |
| 1747-H | Sept. 9. Huachinera. Upper mesquite-grassland. |

- 1749-H Sept. 12. Between San Miguel and Carretas. Mesquite-grassland.
 260- 303-P June 23. Cañón de la Escalera. Lower oak-grassland.
 2793-2823
 304- 317-P June 24. Cañón de los Metates,¹¹ a branch of the Excalera. Upper
 2824-2832 oak-grassland.
 2833-2835 June 25. Cañón de la Escalera.
 2836-2850 June 25. Puerto de los Aserraderos. Lower pine forest.
 2851-2873 June 27. Bavispe. Mesquite-grassland.
 2874-2906 June 28. Labores de Durazno, about 3 km. south of Bavispe along
 river. Mesquite-grassland.
 318- 334-P June 29. Arroyo de Bavispe, east of Bavispe. Mesquite-grassland.
 2907-2908 June 30. Bavispe.
 2909 July 2. Horconcitos. Upper mesquite-grassland.
 335- 336-P July 4. Bacapiri. Lower oak-grassland.
 337- 339-P July 7. Aguaje de Bacatejaca. Mesquite-grassland.
 2910-2925b
 340- 344-P July 7. La Palmita. Lower oak-grassland.
 2926-2933
 345- 347-P July 8. La Galera, north of Bacadéhuachi. Mesquite-grassland.
 2934-2938
 348- 351-P July 11. Horcencitos. Upper mesquite-grassland.
 2939-2992
 2993 July 17. Bavispe.
 352- 363-P July 25. Cañón de Bavispe, 5-8 km. west of Bavispe. Mesquite-
 2994-3026 grassland.
 364- 365-P July 26. Cañón de las Estaces. Mesquite-grassland.
 3027-3048
 366- 373-P July 27. Arroyo de la Galera, south of Bavispe. Mesquite-grassland.
 3049-3064
 3065-3066 July 29. Bavispe.
 3067-3091a July 30. Cañón de las Estacas.
 374- 384-P July 30. Cañón del Carricito, a small branch of the Estacas. Upper
 3092-3102 mesquite-grassland.
 385- 393-P July 31. Cañón de Bavispe. Lower oak-grassland.
 3103-3127
 394- 399-P Aug. 3. Cañón de la Escalera.
 3128
 3129 Aug. 4. Puerto de las Playitas, above Cañón de la Escalera. Oak-
 grassland.
 411- 418-P Aug. 4-6. Puerto de los Aserraderos.
 3130-3185
 3186-3202 Aug. 7. Cañón de la Ciénaga Alta, a small canyon north of
 Aserraderos. Pine forest.
 419- 434-P Aug. 7. Above Rancho de Cruz Díaz. Pine forest.
 3203-3205
 435- 448-P Aug. 8-9. Puerto de los Aserraderos.
 3206-3225
 449- 487-P Aug. 11-12. Cañón de Bavispe. Upper oak-grassland.
 3226-3278
 488-509-P Aug. 13. Rancho de Cruz Díaz. Pine forest.
 3279-3290
 510- 565-P Aug. 13-14. Cañón de Bavispe.
 3291-3317a
 3318-3339 Aug. 15. Cañón de la Petaquilla, a small branch of the Bavispe.
 Oak-grassland.
 566- 579-P Aug. 18. Las Tiarritas del Tremblor. Pine forest.
 3340-3363
 580- 615-P Aug. 19. Cañón del Temblor. Oak-grassland.
 3364-3392
 616- 666-P Aug. 19-21. Las Tierritas.
 3393-3443
 667- 701-P Aug. 22. Between Las Tierritas and El Tigre. Pine forest.

¹¹This is an archaeological site mentioned by Bandelier (3).

- 3444-3473
 3474-3479 Aug. 23. Las Tierritas.
 702- 730-P Aug. 23. Head of Cañón Internacional. Lower pine forest.
 3480-3508
 3509-3514 Aug. 23-24. Las Tierritas.
 731- 736-P Aug. 24. Cañón del Temblor.
 737-P Aug. 24. Las Tierritas.
 738- 740-P Aug. 25. Between Las Tierritas and Cañón de la Gallina. Pine forest to upper mesquite-grassland.
 741- 749-P Cañón de la Gallina. Upper mesquite-grassland.
 3515-3525
 3526-2539 Aug. 28. Cañón de los Otates. Mesquite-grassland.
 750- 766-P Aug. 28. Valle de Teras. Mesquite-grassland.
 3540-3564
 3565-3578 Aug. 29-30. Cañón de las Bellotas. Mesquite-grassland.
 767- 780-P Aug. 30-31. Cañón del Agua Amarga. Lower oak-grassland.
 3579-3645
 781- 801-P Sept. 1-3. Piedra Parada. Oak-grassland.
 3646-3675
 3676-3681 Sept. 3. Cañón de los Apaches.
 802- 813-P Sept. 3. Rancho de Babidianchi, Cañón de Huépari. Oak-grassland.
 3682-3711
 813- 870-P Sept. 5-7. Horconcos and vicinity.
 3712-3810

1941

- 1750-1754-S Aug. 7. 5-10 km. east of Agua Prieta, road to Colonia Morelos.
 3817-3838 Elev. 1200 m.
 1755-S Aug. 8. 6 km. south of Agua Prieta. Elev. 1200 m.
 3839-3848
 3849-3853 Aug. 8. 19 km. south of Agua Prieta, road to Fronteras. Mesquite-grassland.
 3854-3858 Aug. 9. 2 km. south of Agua Prieta, road to Fronteras. Elev. 1200 m.
 1756-1783-S Aug. 9-12. Hacienda San Rafael, 975 m.
 3859-3904
 1784-1787-S Aug. 13. La Angostura. Elev. 855 m.
 1788-1803-S Aug. 13. 1032 km. west of La Angostura. Elev. 1190 m.
 1804-1831-S Aug. 14-15. La Nacha, 1310-1525 m.
 3905-3954
 1832-1837-S Aug. 16. 32 km. west of La Angostura, 1130 m.
 3955-3969
 1838-1851-S Aug. 16-18. La Nacha.
 3970-4017
 1852-1863-S Aug. 19. 14 km. west of La Angostura, 885 m.
 4043-4054
 1864-1872-S Aug. 20. Río Fronteras at El Tajo, 1280 m.
 4055-4077
 4078-4100 Aug. 20. La Nacha.
 1873-1874-S Aug. 21. Hacienda San Rafael.
 1874-1893-S Aug. 24 27. Colonia Morelos, 795 m.
 4101-4147
 1894-1899-S Aug. 28. Rancho de los Robles, 915 m.
 4148
 1900-1911-S Aug. 29. La Fiebre, Cañón de la Palomita, 1130 m.
 4149-4160
 1912-1918-S Aug. 30-31. La Matancita, 2 km. west of El Tigre, 1300 m.
 4161-4174
 1919-1926-S Sept. 1. Between El Tigre and El Roble, 1830 m.
 1927-1973-S Sept. 2-13. El Roble, 1830 m.
 4175-4414
 1974-1983-S Sept. 14. North of El Roble, on trail to Colonia Morelos, 1830 m.
 1984-2009-S Sept. 15-18. Colonia Morelos and vicinity.
 4415-4430

2010-2018-S	Sept. 19.	Agua Zarca, south of Colonia Morelos, 1040 m.
4431-4452a		
2019-2027-S	Sept. 19-21.	Colonia Morelos.
4453-4464		
2028-2032-S	Sept. 22.	Western foothills of the Sierra de la Cabellera, 1040 m.
4465-4486		
4487-4510	Sept. 23.	Colonia Morelos.
2033-2048-S	Sept. 24.	Puerto del Molino Quemado, east of Colonia Morelos,
4511-4537		1000 m.
2048-2060-S	Sept. 25.	Mesa de las Carreras, west of Colonia Morelos, 795 m.
4538-4552		
4553-4556	Sept. 26.	Colonia Morelos.
4557-4573	Sept. 26.	Mesa de las Carreras.
2061-2066-S	Sept. 30.	4 km. east of Colonia Morelos, 795 m.
4574-4608		
4609-4611	Oct. 1.	Puerto del Molino Quemado.
4612-4618	Oct. 2-4.	Colonia Morelos.
4619-4623	Oct. 5.	Between Colonia Morelos and El Curmarito, about 800 m.
2067-2077-S	Oct. 5.	Rancho del Cumarito, 1190 m.
4624-2632		
2078-2092-S	Oct. 6.	Puerto del Cumarito, 1650 m.
4633-4660		
2093-2113-S	Oct. 7-8.	Cañón de la Bellota, Sierra de la Cabellera, 1310 m.
4661-4702		
4703-4724	Oct. 8.	Cañón de la Mescalera, a branch of the Bellota, 1495-1585 m.
4725-4726	Oct. 8.	Cañón de la Bellota.
2114-2125-S	Oct. 9.	Head of Cañón de la Mescalera, 1770 m.
4727-4753		
4754-4761	Oct. 9-10.	Cañón de la Bellota.
2126-2137-S	Oct. 11.	El Bilito, ¹² 1890 m.
4762-4765		
2138-2160-S	Oct. 12.	About 5 km. east of El Bilito, 2080 m.
4766-4800		
4801-4814	Oct. 12-13.	El Bilito.
2161-2168-S	Oct. 13.	Picacho del Pilar, 2080-2310 m.
4815-4832		
4833-4843	Oct. 14.	El Bilito.
4844-4849	Oct. 14.	Between El Bilito and Colonia Morelos, 1740 m.
2169-2172-S	Oct. 15.	La Vega Azul, southwest of Colonia Morelos, 730 m.
4850-4885		
2173-2187-S	Oct. 19.	11 kms. east of Douglas, Ariz., on road to San Bernardino,
4884-4888		about 1200 m.

TABLE OF ALTITUDINAL DISTRIBUTION

The vertical ranges of some of the more common plants of the Bavispe River region are presented in the following table. The species which are found in more than one vegetational type are placed in whichever zone they are most common. Thus *Eriogonum Abertianum* grows at elevations as high as 1800 m., but it is clearly a plant of the lowlands, judging by its abundance and presence in various types of habitat in the mesquite-grassland.

The ranges as given below are mostly based on at least four collections, supplemented in some instances by recorded observation. No attempt was made in the field to determine the exact altitudinal extremes of the different species, and the limits given should be regarded only as approximations. Certainly, however, these plants are rare beyond the limits indicated, except the many mesquite-grassland

¹²The name is apparently derived from the American nickname "Bill."

species which extend indefinitely below our lowest recorded elevation of 795 m. (Colonia Morelos). Some of the plants of the lower Bavispe valley are here shown at 600 m. (estimated).

Elevation in meters	1000	1500	2000
<i>Gomphrena Sonorae</i>	_____		
<i>Rhus microphylla</i>	_____		
<i>Haplophyton camicicidum</i>	_____		
<i>Chilopsis linearis</i>	_____		
<i>Echinocereus rigidissimus</i>	_____		
<i>Atriplex canescens</i>	_____		
<i>Aster lagetinus</i>	_____		
<i>Baccharis glutinosa</i>	_____		
<i>Haplopappus gracilis</i>	_____		
<i>Parthenium incanum</i>	_____		
<i>Selloa glutinosa</i>	_____		
<i>Verbesina encelioides</i>	_____		
<i>Cucurbita foetidissima</i>	_____		
<i>Croton texensis</i>	_____		
<i>Euphorbia heterophylla</i>	_____		
<i>Jatropha cardiophylla</i>	_____		
<i>Fouquieria splendens</i>	_____		
<i>Ephedra trifurca</i>	_____		
<i>Aristida Adscensionis</i>	_____		
<i>Bouteloua filiformis</i>	_____		
<i>B. Rothrockii</i>	_____		
<i>Hilaria mutica</i>	_____		
<i>Muhlenbergia monticola</i>	_____		
<i>Pappophorum Wrightii</i>	_____		
<i>Sporobolus Wrightii</i>	_____		
<i>Triodia mutica</i>	_____		
<i>Acacia constricta</i>	_____		
<i>Prosopis chilensis</i>	_____		
<i>Eriogonum Abertianum</i>	_____		
<i>Cheilanthes Lindheimeri</i>	_____		
<i>Clematis Drummondii</i>	_____		
<i>Salix Gooddingii</i> var. <i>vallicola</i>	_____		
<i>Celtis pallida</i>	_____		
<i>C. reticulata</i>	_____		
<i>Larrea divaricata</i>	_____		
<i>Rhus choriophylla</i>	_____		
<i>R. Rydbergii</i>	_____		
<i>R. virens</i>	_____		
<i>Microsiphonia Brachysiphon</i>	_____		
<i>Tecoma incisa</i>	_____		
<i>Amoreuxia palmatifida</i>	_____		
<i>Guardiola platyphylla</i>	_____		
<i>Hieracium Fendleri</i>	_____		
<i>Zexmenia podocephala</i>	_____		
<i>Zinnia multiflora</i>	_____		
<i>Evolvulus alsinoides</i>	_____		
<i>E. arizonicus</i>	_____		
<i>Ipomoea ancisa</i>	_____		
<i>Arbutus arizonica</i>	_____		
<i>Arctostaphylos pungens</i>	_____		
<i>Cnidioscolus angustidens</i>	_____		
<i>Manihot angustiloba</i>	_____		
<i>Quercus arizonica</i>	_____		
<i>Q. chihuahuensis</i>	_____		
<i>Q. Emoryi</i>	_____		

Elevation in meters	1000	1500	2000
<i>Q. hypoleucoides</i>	_____	_____	_____
<i>Q. oblongifolia</i>	_____	_____	_____
<i>Q. Toumeyi</i>	_____	_____	_____
<i>Q. viminea</i>	_____	_____	_____
<i>Garrya Wrightii</i>	_____	_____	_____
<i>Geranium Wislizeni</i>	_____	_____	_____
<i>Aristida Schiedeana</i>	_____	_____	_____
<i>Bouteloua radicata</i>	_____	_____	_____
<i>Hilaria Belangeri</i>	_____	_____	_____
<i>Muhlenbergia Emersleyi</i>	_____	_____	_____
<i>M. polycaulis</i>	_____	_____	_____
<i>Tripsacum lanceolatum</i>	_____	_____	_____
<i>Monarda austromontana</i>	_____	_____	_____
<i>Stachys coccinea</i>	_____	_____	_____
<i>Trichostemma arizonicum</i>	_____	_____	_____
<i>Benthamantha Edwardsii</i>	_____	_____	_____
<i>Milla biflora</i>	_____	_____	_____
<i>Yucca Schottii</i>	_____	_____	_____
<i>Gossypium Thurberi</i>	_____	_____	_____
<i>Fraxinus Greggii</i>	_____	_____	_____
<i>F. velutina</i>	_____	_____	_____
<i>Zauschneria arizonica</i>	_____	_____	_____
<i>Gilia Pringlei</i>	_____	_____	_____
<i>Adiantum Capillus-Veneris</i>	_____	_____	_____
<i>Bommeria hispida</i>	_____	_____	_____
<i>Notholaena aurea</i>	_____	_____	_____
<i>N. sinuata</i>	_____	_____	_____
<i>Bouvardia glaberrima</i>	_____	_____	_____
<i>Heuchera sanguinea</i>	_____	_____	_____
<i>Gerardia Wrightii</i>	_____	_____	_____
<i>Begonia Martiana</i>	_____	_____	_____
<i>Macromeria Thurberia</i>	_____	_____	_____
<i>Silene laciniata</i>	_____	_____	_____
<i>Quercus albaefolia</i>	_____	_____	_____
<i>Q. diversicolor</i>	_____	_____	_____
<i>Agropyron arizonicum</i>	_____	_____	_____
<i>Blepharoneuron tricholepsis</i>	_____	_____	_____
<i>Bromus anomalus</i>	_____	_____	_____
<i>Tigridia Pringlei</i>	_____	_____	_____
<i>Cologania angustifolia</i>	_____	_____	_____
<i>C. Lemmoni</i>	_____	_____	_____
<i>Malaxis corymbosa</i>	_____	_____	_____
<i>Pinus arizonica</i>	_____	_____	_____
<i>P. ayacahuite</i> var. <i>brachyptera</i>	_____	_____	_____
<i>P. cembroides</i>	_____	_____	_____
<i>P. chihuahuana</i>	_____	_____	_____
<i>P. ponderosa</i>	_____	_____	_____
<i>Pseudotsuga mucronata</i>	_____	_____	_____
<i>Pteridium aquilinum</i>	_____	_____	_____
<i>Ceanothus Huichagorare</i>	_____	_____	_____
<i>Cercocarpus eximius</i>	_____	_____	_____

Notes on Ecuadorian Bromeliaceae

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During his explorations in Ecuador in 1943, Dr. Julian A. Steyermark discovered some interesting new species of Bromeliaceae; these, together with a new variety and a species of *Tillandsia* new to Ecuador, are described and illustrated in the following pages.

Mezobromelia fulgens L. B. Smith, spec. nov.

Florifera ultra 1.5 m. alta; foliis rosulatis, 5 cm. longis, utrinque minutissime dissiteque brunneo-lepidotis, vaginis magnis, ellipticis, laminis ligulatis, late rotundatis apiculatisque, 7 cm. latis, viridibus, concolori-

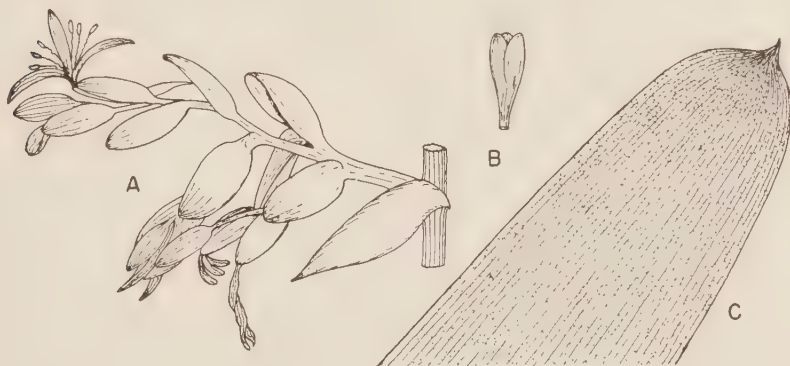


FIG. 1. *Mezobromelia fulgens*. a. branch of inflorescence, $\times \frac{1}{2}$. b. sepal, $\times \frac{1}{2}$. c. portion of leaf, $\times \frac{1}{2}$.

bus; scapo erecto, valido; scapi vaginis erectis, dense imbricatis, infimis foliaceis, supremis late ellipticis, ex sicco castaneis, apice acutis verisimiliter viridibus; inflorescentia laxè ampleque tripinnatim paniculata, fere 6 dm. longa, petalis exceptis omnino rubra (! Steyermark), ex sicco castanea; bracteis primariis e late ovato acutis, ad 6 cm. longis, bases applanatas nudas ramorum paulo superantibus, obscure punctulato-lepidotis; ramis patentibus, ad 17 cm. longis, subdensis; spicis floribusque plus minusve deflexe secundis, spicis paucifloris; rhachi gracili, leviter geniculata; bracteis florigeris late ellipticis, obtusis, ecarinatis, sepala subaequantibus, ex sicco subchartaceis, nervatis, rhachin nullo modo obtegentibus; floribus suberectis; pedicellis validis, 4 mm. longis; sepalis ellipticis, obtusis, 21 mm. longis, ad 5 mm. connatis, bracteis similibus; petalis pallide olivaceis, alte conglutinatis, basi ligulis binis dentatis auctis, laminis ellipticis, 2 cm. longis, stamina superantibus.

Prov. Loja: terrestrial in paramo or edge of sotobosque, between

Tambo Cachiyacu, La Entrada, and Nudo de Sabanillas, altitude 2,500-3,500 meters, October 7, 1943, 54430.

The general habit of *Mezobromelia fulgens* is much like that of *Guzmania candelabrum* André but on a larger scale. In fact it has been necessary to consider the species of *Guzmania* very carefully before describing this new *Mezobromelia*, and in the case of *Guzmania Herthae* Harms I can not be wholly certain of the difference since the description is incomplete and the type probably destroyed. However, I feel that by "folia . . . apice in acumen pungens producta," Harms indicates an acuminate leaf, and his "corollae lobae . . . fere 1 cm. longi vel ultra" seems comparatively small. The flowers of *Mezobromelia fulgens* are few-ranked and so few in a spike that they are easily taken to be distichous.

***Pitcairnia alata* L. B. Smith, spec. nov.**

Caule imperfecte cognito, 5 mm. diametro, foliorum vaginis delapsis dense vestito; foliis multis, vaginis ovatis, atro-castaneis, plus minusve

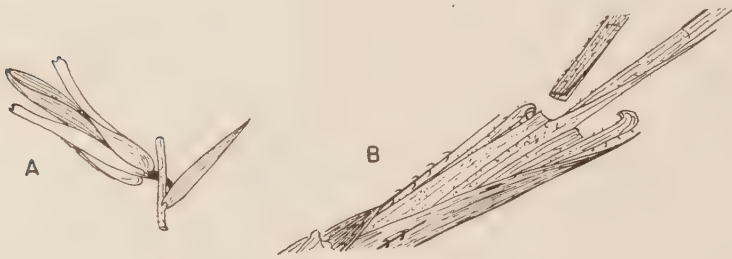


FIG. 2. *Pitcairnia alata*. a. flower, $\times \frac{1}{2}$. b. leaf bases, $\times \frac{1}{2}$.

albido-flocculosis, laminis dimorphis, alteris persistentibus, ad spinas brunneas aculeatas reductis, alteris linea recta transverse deciduis, sub lineam serratis, supra lineam linearibus, acuminatis, haud petiolatis, integris, 4-5 dm. longis, inflorescentiam multo superantibus, 13 mm. latis, pallide flocculosis; scapo erecto, gracili, flocculoso; scapi bracteis erectis imbricatisque, ex ovato longe acuminatis; inflorescentia simplicissima, sublaxe pauciflora; bracteis florigeris eis scapi similibus, quam sepalis brevioribus sed pedicellos multo superantibus; floribus suberectis, plus minusve secundis; pedicellis gracilibus, ad 14 mm. longis, biangulatis; sepalis linearibus, ad 4 cm. longis, obtusis vel truncatis, plus minusve erosis, late alato-carinatis, basi auriculatis, glabris; petalis ad 55 mm. longis, albis, intus nudis; ovario ultra $\frac{3}{4}$ supero; ovulis caudatis.

Prov. Santiago-Zamora: epiphytic on tree-trunk, wooded slopes along ladolid, between Quebrada Honda and Tambo Valladolid, altitude 2000-3000 meters, October 12, 1943, 54606.

This species is easily distinguished from the related *P. lutescens* Mez & Sodiro by its large alate auriculate sepals.

***Pitcairnia erratica* L. B. Smith, spec. nov.**

Caulescens, stolonibus elongatis procreans; caule ca. 1 cm. diametro, foliorum vaginis delapsis dense vestito; foliis multis, vaginis ovatis, brunneis, pallido-lepidotis, laminis dimorphis, alteris persistentibus, ad spinas brunneas aculeatas reductis, alteris linea recta transverse deciduis, sub lineam laxe serratis, supra lineam petiolatis, lineari-lanceolatis, acuminatis, integris, 32 cm. longis, 23 mm. latis, inflorescentiam subaequantibus, mox glabris; scapo erecto, gracili, albido-flocculoso; scapi bracteis erectis, ellipticis, acuminatis, integris, dissite

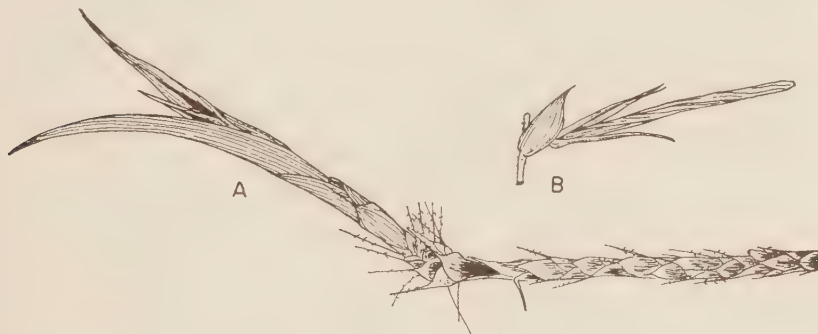


FIG. 3. *Pitcairnia erratica*. a. stolon and leafy branch, $\times \frac{1}{2}$. b. flower, $\times \frac{1}{2}$.

flocculosis, mox glabris, supremis quam internodiis paulo longioribus; inflorescentia simplicissima, dense pauciflora; bracteis florigeris late ovatis, acutis, pedicellos superantibus sed quam sepalis multo brevioribus, flocculosis; floribus suberectis, haud secundis; pedicellis gracilibus, 6 mm. longis; sepalis anguste lanceolatis, acutis, 33 mm. longis, haud vel paulo carinatis, glabris; petalis 65–70 mm. longis, rubris, intus nudis; ovario ultra $\frac{3}{4}$ supero; ovulis caudatis.

Prov. Santiago-Zamora: epiphytic on tree-trunk, wooded slopes along Río Valladolid, between Quebrada Honda and Tambo Valladolid, altitude 2000–3000 meters, October 12, 1943, 54599.

Its petiolate deciduous leaves would indicate that *Pitcairnia erratica* is related to *P. scandens* Ule, from which it differs in its dense non-second inflorescence and short broad floral bracts.

***Pitcairnia Trianae* André var. *retusa* L. B. Smith, var. nov.**

Differt sepalis retusis; petalis haud ultra 25 mm. longis.

Prov. Loja: between Tambo Cachiyacu, La Entrada, and Nudo de Sabanillas, altitude 2500–3500 meters, October 7, 1943, 54461.

***Puya compacta* L. B. Smith, spec. nov.**

Florifera ultra 8 dm. alta; caule 25 mm. diametro; foliis erectis, ultra 3 dm. longis, vaginis ovatis, 4–5 cm. longis, subglabris, laminis linearibus,

longe acuminatis pungentibusque, 2 cm. latis, supra glabris sublucidisque, subtus dense adpresseque pallido-lepidotis, margine spinis atris hamatis ad 6 mm. longis laxe armatis; scapo erecto, valido; scapi vaginis ellipticis, subchartaceis, ex sicco brunneis, sparse floccosis, mox glabris, infimis foliaceo-laminatis, supremis acuminatis pungentibusque, integris; inflorescentia bipinnata, densissime cylindrica, 19 cm. longa, 7 cm. diametro, pallido-flocculosa; bracteis primariis supremis scapi similibus,

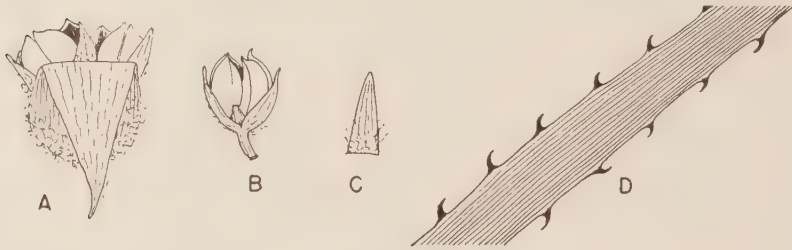


FIG. 4. *Puya compacta*. a. branch of inflorescence, $\times \frac{1}{2}$. b. fruit, $\times \frac{1}{2}$. c. sepal, $\times \frac{1}{2}$. d. part of leaf, $\times \frac{1}{2}$.

7 cm. longis, quam ramis fructiferis axillaribus multo longioribus, verisimiliter reflexis; ramis brevissimis, 2-3-floris; bracteis florigeris anguste triangularibus, sepala subaequantibus, tenuibus; pedicellis gracilibus, ad 10 mm. longis; sepalis anguste triangularibus, 18 mm. longis; petalis staminibusque ignotis; capsulis subglobosis, 2 cm. longis, lucidis.

Prov. Azuay: common on paramos and on flat open ground at lower elevations, between Quinoas and Sausi, altitude 2740-3290 meters, June 16, 1943, 53256.

This species is evidently closely related to *Puya clava-Herculis* Mez & Sodiro, but differs in its long slender pedicels and smaller sepals. Steyermark notes that the base of the fleshy stem and base of leaves deprived of spines are commonly given to pigs for food.

***Puya obconica* L. B. Smith, spec. nov.**

Fragmentis fructiferis solum cognita, dense aggregata (!Steyermark); foliis reflexis (!Steyermark), lamina unica cognita lineari, longe acuminata, altero latere glaberrima, altero inter nervos minutissime pallido-lepidota, margine spinis hamatis ad 7 mm. longis laxe armata; scapo 1.5 m. alto (!Steyermark); scapi vaginis ignotis; inflorescentia laxe bipinnatim paniculata, ca. 1 m. longa, verisimiliter omnino glabra; bracteis primariis subtriangularibus, quam basibus sterilibus elongatis ramorum multo brevioribus; ramis patentibus, lateralibus ad 3 dm. longis; bracteis florigeris ellipticis, obtusis, haud ultra 8 mm. longis; floribus patentibus; pedicellis obconicis, 18 mm. longis; sepalis oblongis, 3 cm. longis, obtusis vel late acutis (apice ipso ignoto); capsulis subglobosis, abrupte acutis, 25 mm. longis; seminibus late alatis.

Prov. Loja: common type, western slopes of Cordillera de Condor

and northwest slopes of Nudo de Sabanillas, around Tambo Cachiyacu, along Río Cachiyacu, about 2 leagues southeast of Yangana, altitude 2000-3000 meters, October 19, 1943, 54806.

If the petals prove to be naked, as is probable, this species belongs next to *Puya Hofstenii* in the Pflanzenreich treatment, but shows little resemblance to it in floral bracts, pedicels or sepals.

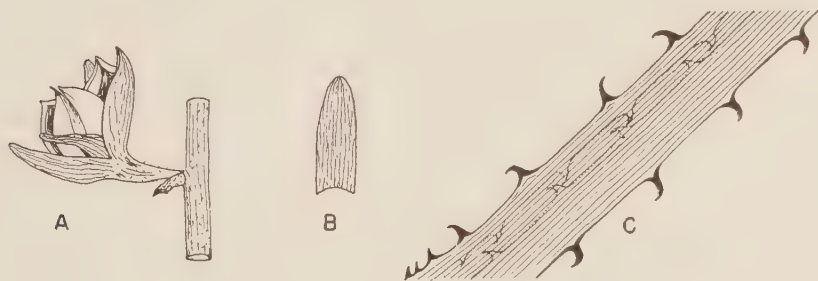


FIG. 5. *Puya obconica*. a. branch of inflorescence, $\times \frac{1}{2}$. b. sepal, $\times \frac{1}{2}$. c. part of leaf, $\times \frac{1}{2}$.

***Tillandsia appendiculata* L. B. Smith, spec. nov.**

Acaulis, florifera 4-9 dm. alta; foliis erectis, 3-7 dm. longis, utrinque dense adpresseque lepidotis, vaginis late ovatis, 7-15 cm. longis, atro-castaneis, laminis angustissime triangularibus, longe acuminatis, 2-3 cm.

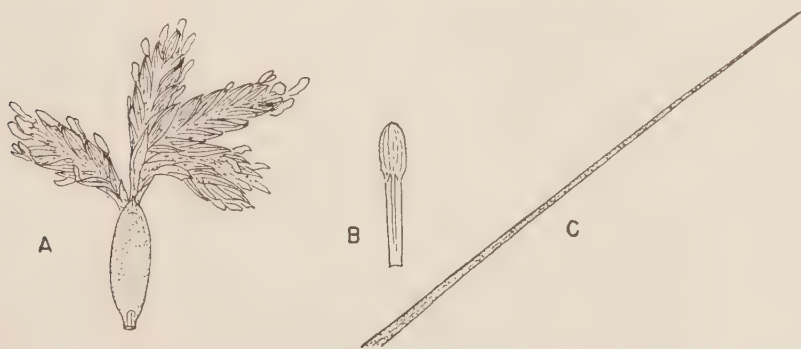


FIG. 6. *Tillandsia appendiculata*. a. branch of inflorescence, $\times \frac{1}{2}$. b. petal, $\times 1$. c. apex of leaf, $\times \frac{1}{2}$.

latis, viridibus; scapo gracili; scapi bracteis imbricatis, ellipticis, lineari-laminatus; inflorescentia dense cylindrica, tripinnatim paniculata, 15-45 cm. longa, 4-9 cm. diametro, dense flocculoso-lepidota; bracteis primariis erectis, plus minusve imbricatis et axin inflorescentiae obtegentibus, ellipticis, apiculatis; ramis spicas 3-5 flabellatim gerentibus, basi bracteatis; spicis horizontaliter patentibus, lanceolatis, acutis, valde complanatis, 3-5 cm. longis, 10-13 mm. latis, densis; bracteis

florigeris imbricatis, lanceolatis, acutis, 10–12 mm. longis, sepala subaequantibus, carinatis, tenuibus, nervatis, roseis; floribus sessilibus; sepalis ovatis, obtusis, glabris, postica paulo connatis; petalis sepalis ad 6 mm. longioribus, crenulatis, azureis vel violaceis vel roseis, auriculis binis verticalibus auctis, stamina superantibus.

Prov. Loja: epiphyte on tree, western slopes of Cordillera de Condor and northwest slopes of Nudo de Sabanillas, around Tambo Cachiyacu, along Río Cachiyacu, about 2 leagues southeast of Yangana, altitude 2000–3000 meters, October 19, 1943, 54780 (type): Cajanuma, altitude 2400 meters, May 7, 1946, *Reinaldo Espinosa* no. E 353 (cotype).

The flower of this species is practically indistinguishable from that of *T. heterandra* André but the branches of the inflorescence are divided with the spikes in fan-like fascicles.

TILLANDSIA ROPALOCARPA André.

Prov. El Oro: between Curtincapa and Guagra Uma, 8 miles northeast of Curtincapa on southwest slopes leading to Chapel, altitude 1500–2895 meters, August 16, 1943, 53921. Widely distributed in Colombia, new to Ecuador. The present specimen has scape-bracts relatively large in comparison to the internodes but this may be due in part to its immaturity.

A New Variety of *Gnaphalium sandwicensium* Gaud. in the Hawaiian Islands

EARL EDWARD SHERFF

(*Chicago Teachers College, Chicago, Ill.*)

For more than two decades Mr. Otto Degener has made special note of *Gnaphalium* as it occurs in the Hawaiian Islands. He has collected and distributed many specimens, mostly determined by him more or less provisionally as *G. sandwicensium* Gaud. Recently a set of his plants on deposit at the New York Botanical Garden has been lent me for study in conjunction with the large assemblage of *Gnaphalium* specimens at the Chicago Natural History Museum. Among Mr. Degener's plants is a suite of at least four collected along the southern coast of western Molokai. These represent an apparently localized endemic form and were suspected by him of representing a new species. They seem best regarded as a new variety of *G. sandwicensium* Gaud.:

***Gnaphalium sandwicensium* Gaud. var. *molokaiense* Degener & Sherff, var. nov.**

Tota planta perspicuissime albo-tomentosa. Caules prostrati erective, 1-3 dm. alti. Folia spathulata vel subanguste obovata, usque ad 1.8 cm. lata. Involucrum densius longiusque tomentosum, tantum bractearum apicibus expositis.

Entire plant very noticeably white-tomentose. Stems prostrate or erect, 1-3 dm. tall. Leaves spatulate or narrowish obovate, up to 1.8 cm. wide. Involucre more densely and elongately tomentose, only the tips of the bracts exposed.

Specimens examined: *Otto Degener* 18,302, rather localized on arid, hot coastal dunes, near Waiahewahewa Gulch, west Molokai, Apr. 19, 1928 (type and 3 isotype sheets in Herb. New York Bot. Gard.).

In its combination of characters, var. *molokaiense* seems unique. On comparison with a wide diversification of *G. sandwicensium* material, however, these characters can be matched one by one except, apparently, the remarkably large extra amount of woolliness on the involucre.

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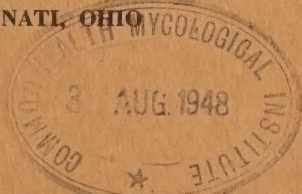
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